Pit and Quarry

With which is consolidated

CEMENT-MILL & QUARRY

Member Audit Bureau of Circulations

Reaches Largest Number of Plants

Vol. XIX | NOVEMBER 20, 1929 | No. 4

for

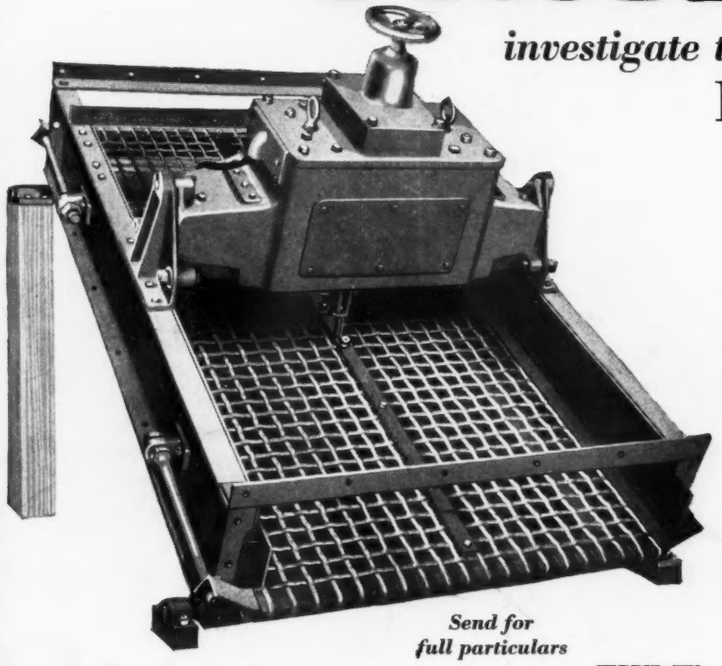
COARSE GRADING!

investigate the

New Floating Screen
" Vibration
" Sorting Action
" Ruggedness
" Power
" Dependability *of*

TYPE 60

HUM-MER *Electric* SCREEN



Send for full particulars

THE W. S. TYLER COMPANY, *Cleveland, Ohio*

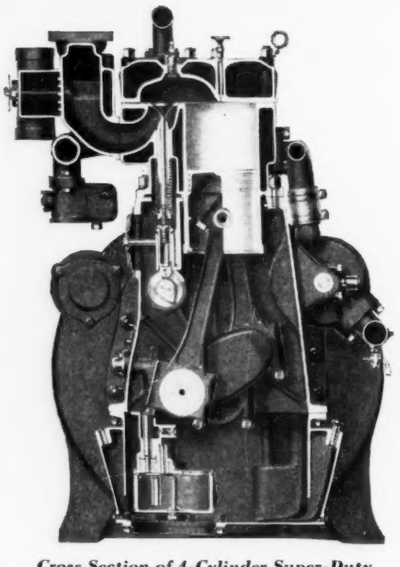
HUM-MER Electric SCREEN

Printing Of This Issue 7,000 Copies Net

hidden flaws DETECTED

BEFORE any connecting rod is put into a Waukesha engine it is "right." After leaving the forge shop each rod is subjected to the *special deflection test.* Even the most minute defect, either in heat treatment or quality of material, cannot "get by." It was Waukesha engineering ingenuity that devised this simplest and most positive test. . . that definitely determines the fitness of a connecting rod to stand the stress of heavy duty in the modern industrial engine. *Waukesha connecting rods stand up.*

Bearing distortion is also eliminated. The reinforced connecting rod caps are heavily ribbed and held in place by four big, special heat treated bolts. Besides this great bearing stiffness, the large end of the connecting rod is ground to fit the removable bearing. Many other reasons for the long life of Waukesha engines are given in Bulletin 556. Write *Industrial Equipment Division, Waukesha Motor Company, Waukesha, Wisconsin. Offices: New York, 8 West 40th Street; San Francisco, 7 Front Street.*



Cross Section of 4-Cylinder Super-Duty Waukesha Engine

978

WAUKESHA ENGINES

ACCEPTING THE CHALLENGE

"Watch her dig! That's the toughest rock digging you'll find anywhere, but watch her do her stuff. It takes a Bucyrus-Erie to turn out the tonnage." . . . Such statements are often heard. Unfailing performance on the hardest jobs has built such confidence in Bucyrus-Erie shovels.

In pit and quarry, all over the world, Bucyrus-Erie equipment is setting new records for dependable low-cost operation. Through long experience and intimate study of quarrying needs, each machine has been developed to do the special work it is built for. In each machine you find the proper distribution of weight, the correct application of power, and the true relationship of every part that must exist for reliable operation and long service.

Tell us about your job, let our engineers make recommendations and explain our facilities for world-wide service.

Power shovels, clamshells, cranes, draglines, dragshovels—½ to 16 yard capacity—electric, steam, gasoline, Diesel, gas + air, Diesel + air.

Dipper, hydraulic and placer mining dredges. Tower-excavators and Railway cranes.

10-PQ-11-29-29

BUCYRUS-ERIE COMPANY

Plants: South Milwaukee, Wis., Erie, Pa., Evansville, Ind. General Offices: South Milwaukee, Wis.
Branch Offices: Boston, New York, Philadelphia, Atlanta, Birmingham, Pittsburgh, Buffalo, Detroit, Chicago, St. Louis, Dallas, San Francisco.

Representatives throughout the U. S. A. Offices and distributors in all principal countries.

BUCYRUS ERIE

Pit and Quarry

With which is consolidated CEMENT-MILL & QUARRY

Member Audit Bureau o Circulations

Reaches Largest Number of Plants

Published Biweekly on Wednesday for Producers and Manufacturers of Sand, Gravel, Stone, Cement, Gypsum, Lime, and Other Non-Metallic Minerals.

Subscription price: $5 for 3 years, $2 for 1 year in the United States and possessions, North, Central and South America; elsewhere $1 additional for each year. Single copies 20c.

Entered as second-class matter October 9, 1928, at the Post Office at Chicago, Illinois, under the Act of March 3, 1879.

Published and copyrighted, 1929, by the

COMPLETE SERVICE PUBLISHING COMPANY

538 South Clark Street, Chicago, Illinois

H. W. BAUMGARTNER, *President*

V. E. LARSEN, *Vice-President*

ARTHUR J. HOSKIN, *Editor*

J. O. DURKEE, *Assistant Editor*

W. E. TRAUFFER, *Assistant Editor*

S. A. PHILLIPS, *Assistant Editor*

G. B. MASSEY, *Associate Editor*

G. F. SONDRAKER, *Associate Editor*

New York Representative:

L. M. WEISS, 315 W. 86th St.; Telephone, Schuyler 6294; New York, N. Y.

Vol. XIX CHICAGO, NOVEMBER 20, 1929 No. 4

FEATURE CONTENTS

Cement and Gypsum Plants at Hanover, Mont., Operated by Three Forks Portland Cement Co. 27

Small Gravel Operator at North Star, Mich., Built His Barge During Winter.... 33

Problems Confronting the Industrial Commission 36

Diesel Engines—Their Present and Possible Application in the Pit and Quarry Industries 39

Leonard Gravel Company at Lansing, Mich., Has Unusual Method of Stockpiling. 53

Concrete Mixing Plant Erected for Use During Erection of Power Plant..... 58

Many Improvement Mark the Coming Edition of PIT AND QUARRY HANDBOOK. 59

Pedrara Quarries Supply Much of the Onyx Used in the United States..... 67

Separate Plants Produce Sand and Gravel for Local Consumption in Denver..... 73

Albany Trucking Corporation Central Mixing Plant at Capacity in First Year of Operation 79

Floatstone Company Prepares Industrial Products from Diatomaceous Earth... 83

Mining and Washing Practices in the Hard-Rock Phosphate District of Florida.. 89

Combination of Lime with Ingredients of Argillaceous Rock in Progressive Heating of Raw Cement Mixture..... 45

Slate Flooring Is Laid with Sawed Tile of Standard Dimensions..... 49

Effect of a Bonus on the Accident Record of the Southwestern Portland Cement Co. 51

Methods of Crushing, Washing and Grinding Barite in France..... 61

Internal Check Factors for Organization Personnel 63

Development of the American and Canadian Gypsum Industry..... 70

Accident Hazards from the Use of Conveyors About Pits, Quarries and Plants 71

Opponents of Metric System Present Their Case 87

Feldspar Has Attained Prominence in Numerous Modern Manufacturing Industries 92

Compressive Strength of Slag Concrete... 95

Items for Depletion Should Be Allowed in Income Tax Returns 98

Age of Machinery and Its Aftermath..... 99

Men of the Industry..... 101

Personal Mention 106

Insurance Problems Discussed..... 107

Financial News Corporate and Business... 109

Legal Information for Operators..... 112

Traffic News and Comment..... 115

Review of Foreign Practice..... 116

Latest News Flashes..... 118

New Machinery and Supplies..... 119

Next Issue December 4, 1929

Pit and Quarry
With which is consolidated
CEMENT-MILL & QUARRY

Vol. XIX CHICAGO, NOVEMBER 20, 1929 No. 4

Cement and Gypsum Plants at Hanover, Montana, Operated by Three Forks Portland Cement Co.

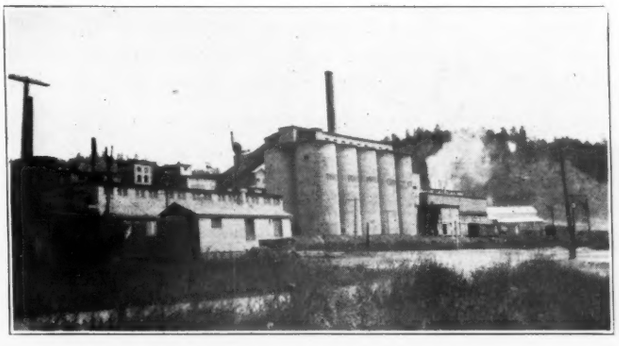
Geological, Geographical and Historical Outline of the Operations Together with Many Unique Features in Design

By F. C. LINCOLN
Professor of Mining, South Dakota State School of Mines, Rapid City, South Dakota

HANOVER, Montana, presents the unusual sight of a cement plant and a gypsum plant belonging to the same company located side by side and extracting their raw materials from adjoining beds. Hanover is in Fergus County, central Montana, on Big Spring Creek in the foothills of the South Moccasin Mountains. It is on the Great Northern and the Chicago, Milwaukee & St. Paul Railways, seven miles northwest of the city of Lewistown. Its situation is not only convenient but picturesque, and it has recreational as well as economic facilities. There is good deer hunting to the north and good fishing in the stream on whose bank it lies. Indeed, a 22½-pound trout taken from Big Spring Creek near the site of the cement plant a few years ago was the largest caught in the United States that year. The cement and gypsum plants, the shale quarry, and the gypsum mine, are on the north bank of Big Spring Creek on a hill which is separated from the main mass of the South Moccasin Mountains by about one mile; the limestone quarry is three miles to the north in the main range; and the town of Hanover is just to the south across Big Spring Creek from the plants.

Geology

The Hanover hill is structurally a small dome. This dome has been eroded to expose the Quadrant formation (Pennsylvanian) in the center, with the Ellis and Morrison formations (Jurassic) and the Kootenai formation (Lower Cretaceous), encircling it and dipping away from it in all directions. Gypsum occurs at the top of the Quadrant formation in a series of thin beds separated by shales and limestone.[1] The bed which is being mined is 8 ft. in thickness and has a dip of 22 degrees. The shale which is being quarried is apparently the Quadrant shale. Drilling for oil was started near the top of the shale and water was struck in a white sand at a depth of 825 ft. It was a strong artesian flow of 250,000 gallons per day, and a control head was placed upon the well and the water used at the plants and in the town. The limestone quarry in the South Moccasin Mountains to the northward is in the Madison Limestone of Mississippian age.

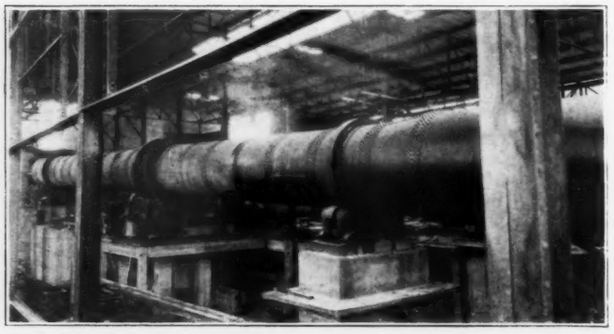


Mill as viewed from the office

Early History of Property

The Hanover Gypsum Company obtained title to about 1,000 acres of land on the Hanover dome, and began the construction of a gypsum plant there in 1915. This plant was completed at a cost of about $150,000 in July, 1916, but after operating for a few days was sold to the Three Forks Portland Cement Company.[2] This company had built the first cement mill in Montana at Trident in 1909 and put it in operation in June, 1910, as described in a previous article.[3] The Three Forks Portland

(1) Stone, R. W., and Others, "Gypsum Deposits of the U. S.," U. S. Geol. Survey Bull. 697 (1920) pp. 135-6.
(2) Freeman, O. W., "Gypsum and Lime Industry in Central Montana," *Mining and Engineering World* 45 (1916) pp. 663-5.
(3) Lincoln, F. C., "The Trident Plant of the Three Forks Portland Cement Company," PIT AND QUARRY, November 6, pp. 39-43.



Kiln, 9-ft. diam., 200-ft. length

Cement Company continued to operate the gypsum plant and began the construction of a wet process cement plant which cost about $1,000,000 and went into operation in 1918. The chief engineer in charge of construction was E. Posselt, who afterwards went to South America.

Gypsum Mining

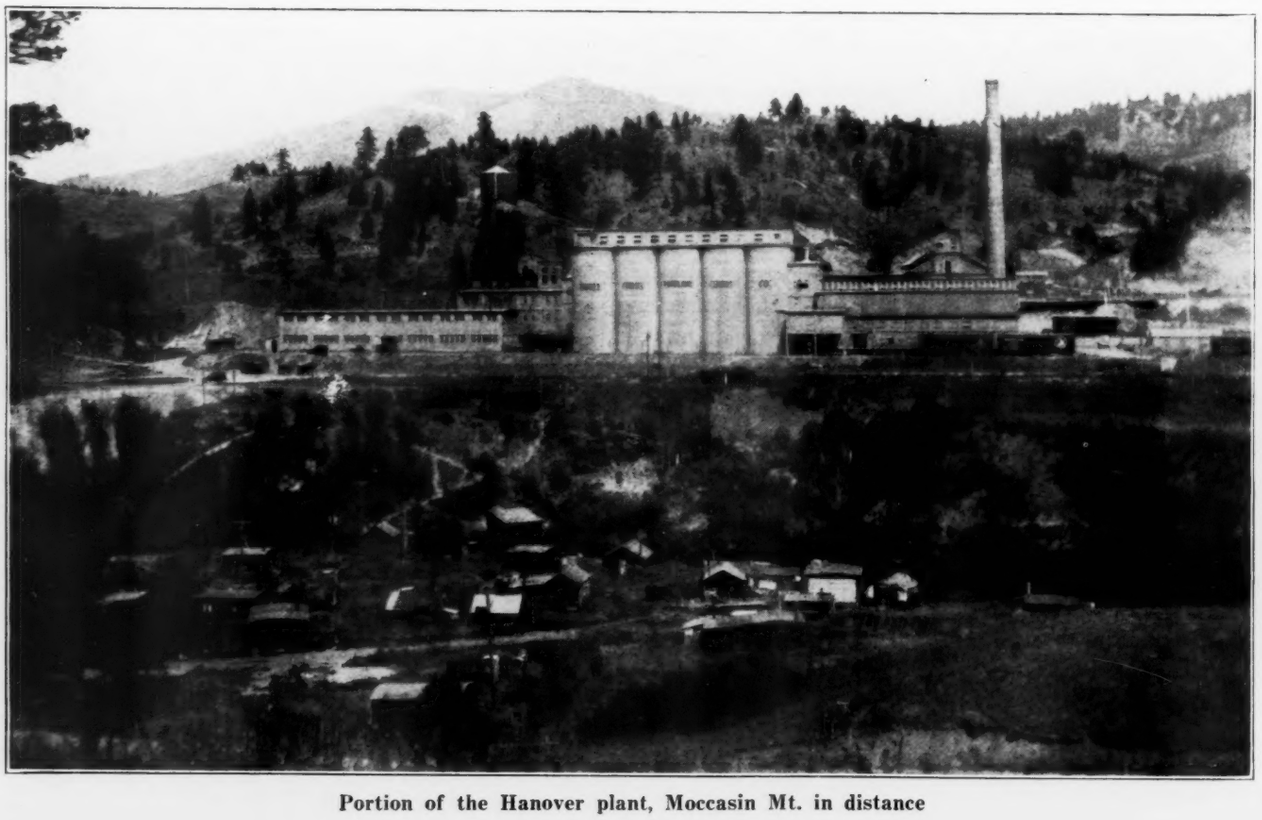
The gypsum mine was opened by an old incline now used as a manway and is now operated through a 135-ft. vertical working shaft. This shaft contains two compartments in which combined cages and skips work in balance, the power being supplied by a 20-hp. Vulcan electric hoist. One cubic yard of gypsum weighing 2,500 pounds is raised in a skip at a time. The bed mined is 8 ft. in thickness and dips at 22 degrees. Two 12-in. by 10-in. Ingersoll-Rand air compressors furnish the air for the 8 Jackhamer drills employed. The holes are loaded with 20 per cent gelatin Du Pont and Hercules dynamite and fired with fuse and No. 6 caps. The natural ventilation is so good that a 3-ton Plymouth gasoline locomotive is safely employed for haulage. A 2½-ton Whitcomb gasoline engine is now being given a trial in the mine. Pillars of gypsum 10 ft. in diameter are left in the stopes for support at intervals of 100 ft.

The Gypsum Plant

The gypsum plant is a two-kettle plant with a capacity of 200 tons in 24 hours. It manufactures hair-fibred, wood-fibred, and unretarded plasters and land plaster. The skips in the vertical shaft deliver the gypsum to a 24-in. by 36-in. Ehrsam jaw crusher which reduces it to pieces under 4 in. in diameter, when it goes to a No. 5 gyratory crusher which further reduces it to pieces of 1 in. in diameter and less, and is then deposited in storage bins. An Ehrsam belt conveyor carries the crushed gypsum from the bins to a 6-ft. by 40-ft. rotary drier. The dried gypsum is next elevated to bins from which it goes to two 5-roller Raymond mills which pulverize it. The pulverized gypsum is calcined in one of two 10-ft. Ehrsam kettles and goes to the gypsum storage. It is mixed with retarder and fibre in a Dunning mixer. The finished product is sacked by a Bates 4-tube packer.

Operating the Shale Quarry

The shale quarry adjoins the cement mill, being about a thousand feet distant. The quarry face has a height of 50 ft. The shale is soft, requiring no blasting. It is mined by a 60-ton Atlantic steam-shovel which loads it into 7-ton Western side-dump quarry cars. These cars are hauled to



Portion of the Hanover plant, Moccasin Mt. in distance

the No. 7½ Gates type K Allis-Chalmers gyratory crusher by a 3-ton Plymouth gasoline locomotive. It reduces the shale to 1½-in. maximum diameter when it is ready to mix with the crushed limestone. The same gyratory is used for crushing the limestone, but at a different time, and limestone and shale go to different bins. The drillings in the limestone quarry are analyzed, and the cars of shale in the shale quarry grab-sampled and analyzed, in order to determine the proper mixture, which is in the neighborhood of 25 per cent shale to 75 per cent limestone. The crushed shale and limestone are weighed out in the calculated proportions and go to the bin in the grinding section of the cement mill.

Limestone Quarry Operations

The limestone quarry is located upon the top of a mountain, three miles distant from the cement mill. Its face has a maximum height of 100 ft., tapering to 40 ft. Holes are bored with two Armstrong well drills using 6-in. bits. One of these drills is operated by a 10-hp. electric motor and the other by a 20-hp. gasoline engine. Enough limestone to run the mill for six months is shot down at one time, which means about 40,000 tons. Holes are spaced 12 ft. apart and 15 ft. from the face and are carried down 6 ft. below the quarry floor. Formerly a double row of holes were bored and as much as 80,000 tons of limestone were broken in one blast, but now a single row is used and found to give better satisfaction. The holes are loaded

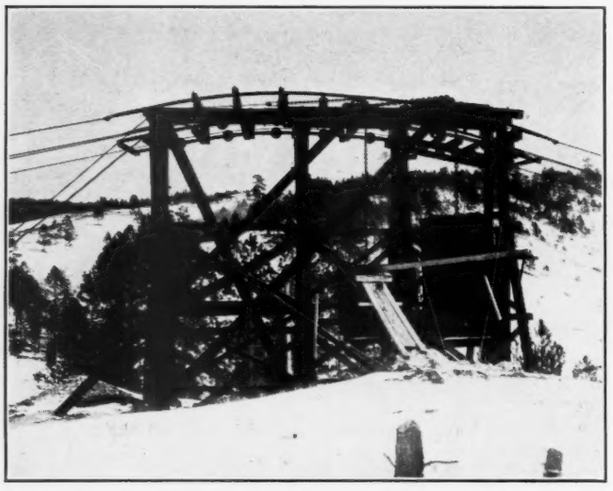
This blast broke down 80,000 tons of rock

with 60 per cent Hercules gelatin dynamite and fired with Cordeau-Bickford fuse. The air for drilling for secondary blasting is supplied by an Ingersoll-Rand 12-in. by 10-in. air compressor, and the holes are loaded with 20 per cent dynamite. The broken limestone is loaded into 7-cubic yard Western side-dump quarry cars by a 90-ton Bucyrus electric shovel and hauled to the crusher by a 7-ton Plymouth gasoline engine. The quarry crusher is a 72-inch Traylor jaw crusher which reduces the limestone to 6 inches in diameter and less. The crushed limestone is received in a bin, from which it passes through loading gates into the buckets of an aerial tramway which carries it to the cement mill.

The Aerial Tramway

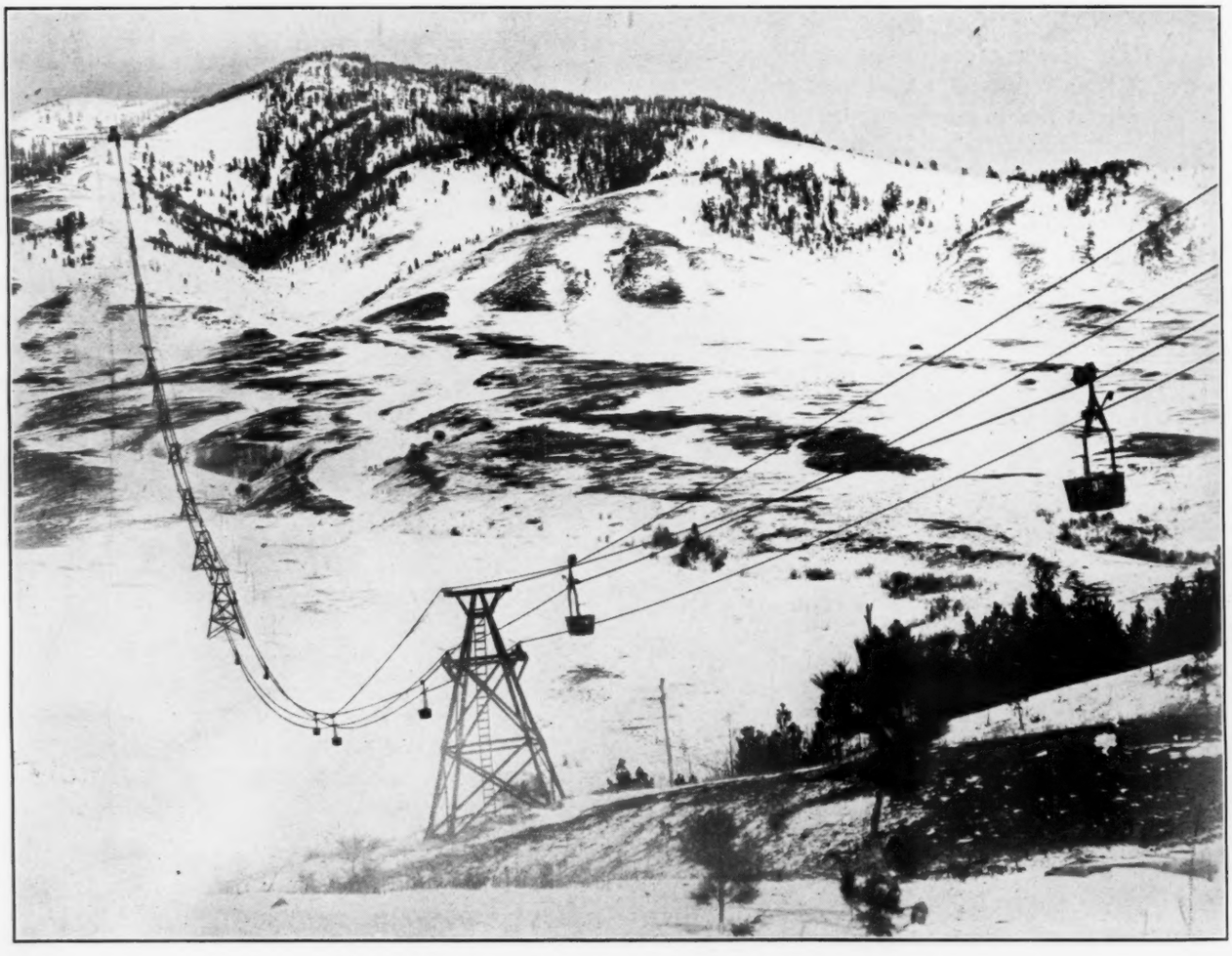
The aerial tramway is 12,465 ft. in length with a fall of 1,590 feet. It was designed, manufactured,

Balance of plant not shown on opposite page



Aerial tramway, tension station

and installed by the A. Leschen and Sons Rope Company of St. Louis. There are 90 carriers on the line, each with a capacity of 1,000 pounds of limestone. They are spaced 300 feet apart; and originally ran at a speed of 500 ft. per minute, giving the tramway a capacity of 50 tons per hour; but this speed has been increased to 600 ft. per minute without ill effect, raising the capacity to 60 tons per hour. The track cables are locked-coil cables, that on the loaded side having a diameter of 1⅜ in. and that on the empty side one of ⅞ in. The original track cables lasted over 10 years. Two years ago, the ⅞ in. locked-coil track cable broke. A new cable could not be secured and installed without great loss of time; and so, contrary to advice, an emergency weld was made. A sleeve 1 ft. in length and ¼ in. in thickness at the center tapering toward both ends was welded about the break, and the tramway put into use again. This weld lasted for six months and was still in good shape when the cable was changed at the end of that period. The track cables are oiled by a traveling oiler which makes the round trip every second day, while the traction cable is oiled by drip. The traction cable is a 6 by 19 Hercules Red Strand cable ⅞ in. in diameter. The original traction cable furnished with the tramway is still in use after twelve years of service; which is even more remarkable than the long life of the track cables, since haulage cables ordinarily last only about one-half as long as track cables. The tramway operates by gravity, its speed being regulated by an air brake.



Aerial tramway, loading terminal in distance

Cement Mill Operations

The aerial tramway buckets, coming from the limestone quarry, dump the broken limestone into a receiving bin from which it is fed into the same No. 7½ Allis-Chalmers gyratory crusher, used at other times for crushing shale. The crushed limestone and the crushed shale are weighed, mixed, and delivered to the bin in the grinding section of the cement mill. These raw materials are then mixed with water and ground in a Smidth Kominutor loaded with 5-in. chrome steel balls and in circuit with a Smidth Trix mill equipped with 0.5-in. by 0.049-in. hit-and-miss screen. Two 6-in. by 22-in. Allis-Chalmers tube mills then reduce the mixture to such a fineness that 88 per cent will pass 200 mesh. Manganoid grinding balls ⅞ in. in diameter are used in the tube mills; experiments conducted at Mason City by Superintendent Capper having shown this size to be most efficient. The resulting slurries are analyzed and mixed in the desired proportions with the help of three correction tanks and three intermediate tanks before going to final storage. The corrected slurry is then burned in a 9-ft. by 200-ft. rebuilt kiln with a 175-ft. concrete stack. Powdered coal is used as fuel and the kiln has a capacity of 1,050 barrels a day. The clinker is cooled in a 6-ft. by 80-ft. rebuilt rotary cooler, mixed with 2¼ per cent raw gypsum from the gypsum mine, and pulverized in a 7-ft. by 22-ft. Allis-Chalmers Compeb mill. This mill uses 4-in. forged steel balls in its first and ⅞-in. chrome steel balls in its second chamber; and once a year the balls in its second chamber are removed and transferred to the raw tube mills, new balls being put in the Compeb mill. A clinker storage of 100,000 bbls. is provided, the clinker going to the storage by belt and being recovered by a belt in a tunnel. An ingenious device is in use in the mill for correcting corrugations and angular wear on rotary flanges. A 100-lb. brick of carborundum is suspended above the flange in such a manner as to wear off the corrugations or angles by the pressure of its weight and the natural rotation of the flange; thus making the flange smooth and square without interrupting the work of the plant. The finished cement storage has a capacity of 80,000 barrels; and the finished product is sacked with the aid of two 4-tube Bates packers. The electricity used in the mill is purchased from the Montana Power Company.

R. J. Morse, general manager, Ideal Portland Cement Co.
Mr. Morse is also Vice-president and general manager of Trident Plant, page 39, November 6, PIT AND QUARRY

J. C. Capper, superintendent

The Coal Mill

The coal used for kiln fuel is sub-bituminous slack from the Roundup coal field. When received

at Hanover this coal contains about 8-10 per cent ash and 5-6 per cent moisture. It is dried in a 5-ft. by 60-ft. home-made rotary drier and pulverized in two 5-roller Raymond mills.

Personnel

The Hanover Plant of the Three Forks Portland Cement Company is one of ten plants which are under the control of the Ideal Cement Company of Denver, Colorado. Charles Boettcher is president of the Ideal Cement Company and R. J. Morse is vice-president and general manager. J. C. Capper is superintendent of the Hanover Plant. He is an expert cement man of wide experience, having been with the Cowham Engineering Company of Jackson, Mich., engaged in cement plant construction for 18 years before coming to Hanover, 10 years ago. His first job with the Cowham Engineering Company was as assistant-superintendent in charge of construction, building a 6-kiln wet process plant at Cement City, Mich., whence he went to Durham, Canada, to construct the National Portland Cement Company's 8-kiln wet process plant, and then to Rockmart, Ga., to construct an 8-kiln dry process plant. He was superintendent of construction for the 8-kiln dry process plant at Independence, Kan., and then went to Mason City, Ia., where he assisted in the construction and operation of the 12-kiln plant of the Northwestern States Portland Cement Company. He next went to Edmonton, Alberta, as superintendent of reconstruction from wet to dry of the cement plant there, coming to Hanover from that job. Walter Weston, master mechanic, has been with Mr. Capper for 20 years. Cal. Birdwell, night foreman, is a cement man of 25 years' experience, and Fred. Friebie, quarry foreman, has been employed by the company since the plant started. Fred Shobbert has been superintendent of the plaster plant for 11 years, but Dub. Allen, mine foreman of the gypsum mine, is new in the company employ. The cement plant employs a total of 95 men; the gypsum plant, 12 men, and the mine, 20 men.

Domestic Mica Equals Foreign Mica in Heat-Resisting Properties

Tests of domestic micas from North Carolina, Maine, New Hampshire, South Dakota and other States have shown that these micas are in every way equal in heat-resisting qualities to foreign micas from Brazil, India, Guatemala, Africa and other countries, according to the United States Bureau of Mines, Department of Commerce, which is conducting a study of the domestic mica situation, in cooperation with the War Department. Preliminary tests of this nature have recently been conducted at the Bureau of Standards. The tests also show the superiority of phlogopite as compared with muscovite in this particular aspect, the phlogopite standing a considerably higher temperature than the muscovite before a physical change takes place. These tests are being continued to obtain specific data as to loss in weight at various temperatures; and bending and di-electric tests will be made on samples after heat treatment over a considerable range of temperature. Tests are also being conducted to determine the power factor of various foreign and domestic micas.

Praise from Competent Critics

PIT AND QUARRY HANDBOOK has won high praise wherever it has been read, in foreign countries as well as in the United States and Canada. Wherever English is understood—from China to South Africa, from Scotland to New South Wales—the HANDBOOK has earned the confidence and good opinion of its readers as a useful aid for the practical operator.

The latest example of this world-wide appreciation to reach us comes from England, where competent and highly critical judges are both numerous and outspoken. In a recent issue of *The Quarry Managers' Journal* the editors of that helpful and well-edited trade paper spoke of the 1929 edition of the HANDBOOK in the following terms:

"The Pit and Quarry Handbook"

A 700-page book, with limp grain leatherette cover, containing information about quarries and quarrying for quarry managers under every conceivable head, from geology to costing and insurance. A liberal quarrying education, published yearly, so that each edition is right up-to-date. Lucky American quarry managers are presented with a copy of this encyclopaedia for 2 dollars only by the publishers of PIT AND QUARRY, who are located at 538 South Clark Street, Chicago. They certainly do things well in the U. S. A.

The publishers claim that it is a complete reference book of classified information, pertinent and useful to the non-metallic mineral industries. After glancing through the book we think their claim is quite modest. For example, we find in the section devoted to loading and transporting the relative costs of transporting one cubic yard 100 feet by twelve different methods, from slip scrapers (whatever they may be!) to belt conveyors, are worked out to three places of decimals of a dollar. Incidentally, the highest cost is by slip scraper .24 dollar (about 1s.) which seems terribly high, and the lowest, belt conveyor, .001 dollar, about 1/20 of a penny. That's pertinent and useful enough, and though not all of the information would be useful on this side, the whole book would interest and help any quarry manager in the world.

Evidently this gift book is made possible by the advertisers. As is well known the Americans are thoroughly converted to advertising. They regard it as an investment and don't expect that 10 dollars worth of space spent to-day will put their factories on overtime next week. Perhaps we shall arrive at that stage soon, and judicious and reasonably big advertising expenditure by our quarries, as well as machine manufacturers, will bring some of the American prosperity here.

In our opinion this book would be cheap at 12s. per copy.

Small Gravel Operator at North Star, Mich., Built His Barge During Winter

The Scow Is Composed of Steel Oil-drums

By THOMAS L. COLLINS

AN UNUSUAL method of constructing a barge for use in his sand and gravel plant near North Star, Mich., was utilized last winter by George E. Reed, president and general manager of the North Star Washed Sand and Gravel Company. Before starting operations in the spring, Mr. Reed had planned for a new barge and, to save time, he conceived the idea of building it on the ice and having it ready for use when the spring thaw came.

The floor of the barge, which is 20 ft. wide and 30 ft. long, was built and assembled under cover and hauled out and erected on oil-drums on the ice. Then the house was built and the machinery installed. To keep it from tipping suddenly when the ice thawed, the barge was moored to the shore by cables. Besides the barge proper a boom supporting the nozzle extends out about 20 ft. The barge and boom rest on a pontoon made of 50-gallon oil-drums.

The method thus adopted was entirely satisfactory, according to Mr. Reed. The work of constructing the barge was done during the off-season and he was ready to start his spring operations on schedule with a new and improved outfit.

This property was originally opened seven years ago as a small pit-run gravel plant, operating a drag and scraper outfit—equipment which is still being used to produce pit-run gravel. After three years, it was changed into a bank-pumping outfit and a 6-in. Ebel pump, made by the former Lansing Motor and Pump Company and operated by a steam traction engine, was installed. The material was graded with a rotary screen operated by a gasoline engine. A hand winch was used for raising and lowering the pump nozzle and a small pontoon made of oil drums was utilized to float the pipe-line.

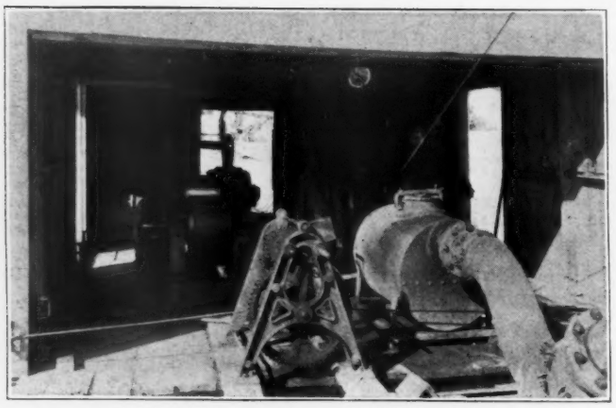
The sand and gravel deposit in which this plant is operating is of glacial origin. It runs diagonally across a tract of eighty acres, about 30 ft. wide, making a total of about six acres. The depth of the deposit in the present pit is about 30 ft.

The overburden consists of about 10 in. of black soil on top, under which is a layer of about 5 ft. of sand. The practice is to put all of this material through the pump; but experiments have shown that it pays to remove the top layer of soil, chiefly because the sod causes considerable plugging of the pipe-line and also because it would reduce the amount of waste which is now carried into the washing-box and must be disposed of there. The present plan contemplates the removal of this sod and a part of the soil with a drag scraper outfit operated by a gasoline tractor.

About 50 per cent of the material here is available as coarse aggregate, the balance being sand which runs finer than ⅛ in. This is very good building and concrete sand but, unfortunately, there is little demand for it in this section, since the only market is for road work, which calls for coarse aggregate with only a small percentage of sand. Mr. Reed has investigated the possibilities of shipping this sand, but has not been able to develop a profitable market because of the added freight charges.

The plant operates until about Dec. 1, when hard freezing weather usually sets in. This cold weather, which necessitates a complete shutdown,

View from south, sand flume at left



Interior of dredge, showing drum hoist, stone box, and portion of pump

continues until about April 1. Five men are employed, one of whom, the dredge foreman, is given employment the year round. During the off-season his services are utilized in repairing machinery and doing odd mechanical jobs around the farm which Mr. Reed operates adjacent to the gravel plant. Last winter his time was well employed in constructing the new barge and installing the additional machinery.

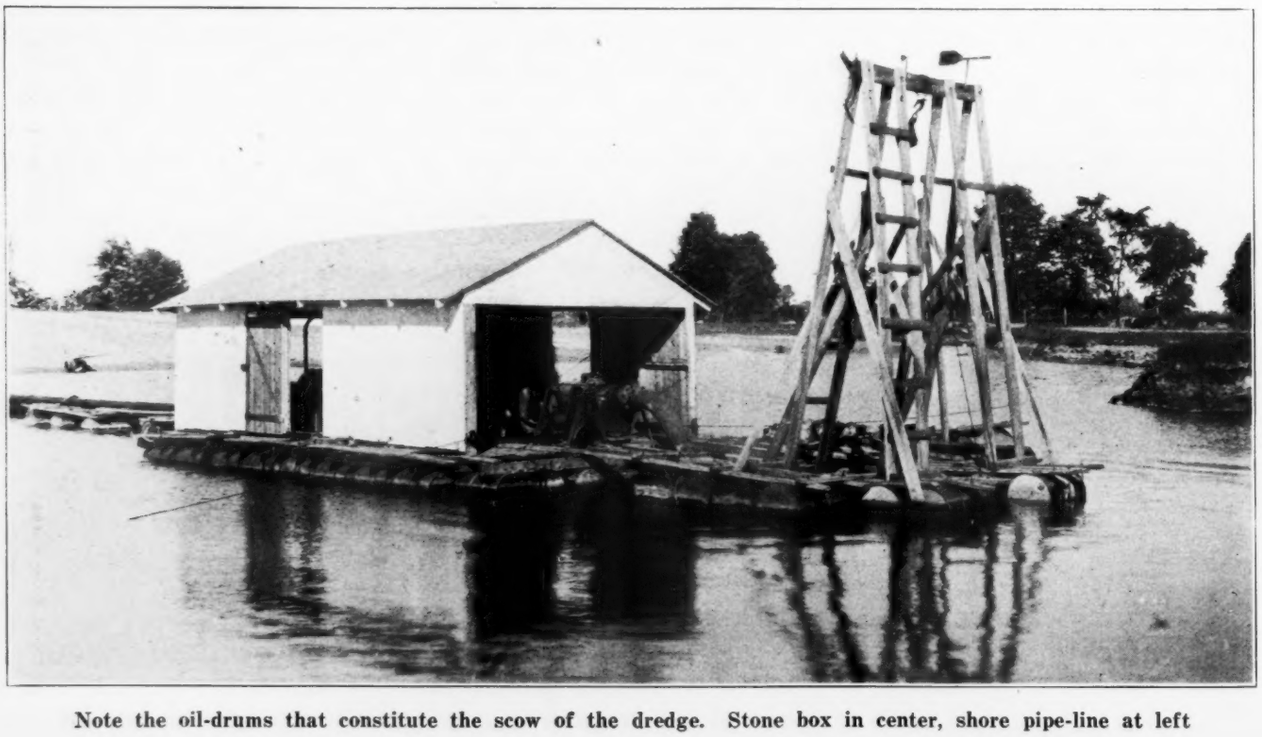
This plant is electrically equipped throughout, with individual motors on most of the machinery. During the summer, power is furnished at a flat rate, which is changed to a horsepower rating during the winter.

A new pump was installed on the barge last spring. It is a Hetherington & Berner 6-in. centrifugal pump, made of manganese steel and operated by a 75-hp. General Electric motor. A 6-in. discharge pipe-line, about 250 ft. long, is used. The nozzle on the pump feeds into a specially constructed stone-box, made by Hetherington & Berner, which was installed the last of June this year.

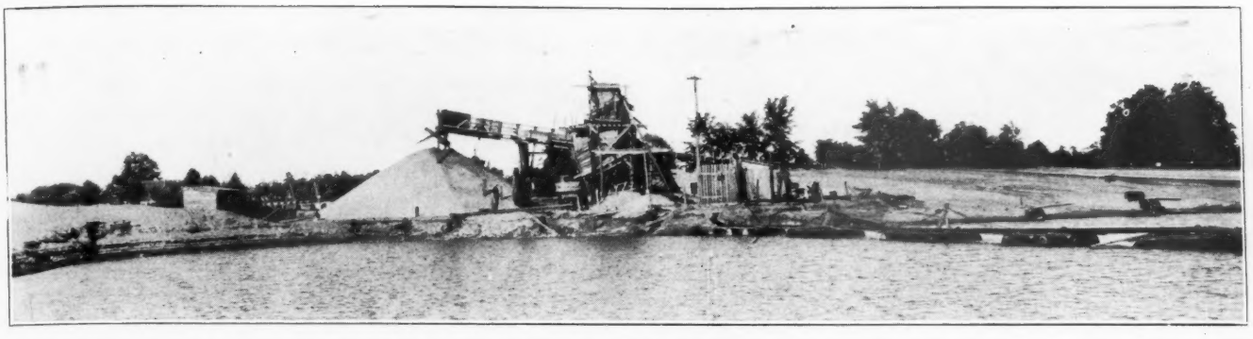
This stone-box, of ½-in. steel, is cylindrical in shape, about 2½ ft. in diameter and about 5 ft. long. The material enters through an 8-in. opening at one end and feeds through a large mesh screen into the discharge pipe-line. This screen is composed of main bars running lengthwise about 5 in. apart, and smaller cross bars about 3½ in. apart. The ends of the main bars are welded to the box. The cross bars are inserted in slots and can be lifted out of position when so desired. The oversize stone and chunks of sod from the overburden lodge on these bars and when a considerable amount has accumulated, the pump is shut down and this oversize stone and the sod are removed by hand through an opening in the top of the box. This opening is closed by a lid which is held in position by clamps when the pump is operating.

This stone-box was designed and built especially to take care of the problems presented by this plant. It has two purposes: one, to catch irregular and wedge-shaped stone which would lodge in the pipe; the other, to catch the sod which might plug the pipe but which occasionally goes through the pipe and lodges on the screen.

For raising and lowering the suction pump, an Ebel single-drum hoist is used, belt-driven by a 5-hp. Western Electric motor. A ½-in. Hazard wire rope is used. The motor also operates, from a belt drive, a small Hetherington & Berner pump which is used for priming the big pump.



Note the oil-drums that constitute the scow of the dredge. Stone box in center, shore pipe-line at left



View from north, North Star Washed Sand and Gravel plant

From the pit the material is forced through the discharge pipe-line which feeds into a home-made wooden intake box, where a part of the water and silt is removed. Thence, it is discharged through a wooden chute onto a 3-ft. by 6-ft. double-deck Simplicity vibrating screen, operated by a 5-hp. Western Electric motor with belt drive. The upper deck of this screen has a 1⅛-in. mesh and the lower deck a 1/10-in. mesh. This screen further dewaters and cleans the gravel and takes out the sand, all in one operation. It was installed in the fall of 1927 and has given excellent service. With this screen alone, the plant produces gravel which meets state specifications for concrete road work.

From the screen the material is discharged into two wooden truck-loading bins, the gravel being discharged into one bin and the oversize into another. The sand is carried off by a flume and deposited in an open stockpile. When the concrete gravel bin is filled, the chute leading to this bin is closed, and the material diverted to a 16-in. rubber belt conveyor with 30-ft. centers, which carries it to an open stockpile. This belt conveyor is operated by a 4-hp. LeRoi gasoline engine.

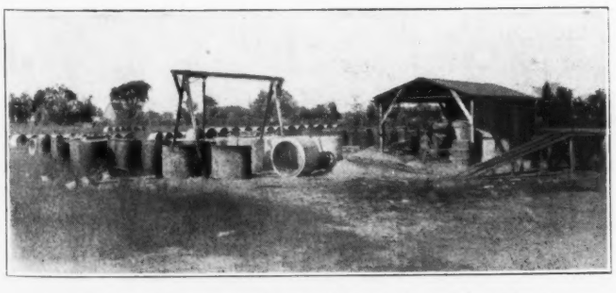
The oversize, which runs about 8 per cent of the coarse aggregate, is trucked out as the bin fills up and dumped in a stock pile. When this material has accumulated in sufficient quantity, Mr. Reed plans to install a crusher for reducing it to the necessary size for concrete road work.

The output of this plant is devoted almost exclusively to road work, sales being made to state, county and township officials. These markets absorb the entire output of the plant except for the excess of sand produced. Facilities for railroad shipping are not, as yet, available, although the main line of the Ann Arbor Railroad runs about one-half mile away. Although this feature of the company's service is not being pushed, a limited amount of deliveries are thus made. Two trucks, an International and a Ford, are owned and operated for local deliveries to small concrete jobs and village street work in North Star and other towns in that vicinity. The International is a 1¼-ton truck and its 1½-cu. yd. body was built by the Galion All-Steel Body Company.

The maximum production of the plant is 200 cu. yd. of concrete aggregate per day. Under present operating conditions and demand for material, Mr. Reed plans a minimum production of 1,000 cu. yd. per week through the operating season. The record to date indicates that the average production this year will be close to that amount.

Besides marketing coarse aggregate for concrete work, this plant supplies a local demand for pit-run gravel which makes a fair grade of concrete. For producing this material, an Ebel dragline scraper with ¾-cu. yd. bucket is used. It is operated by an International gasoline tractor, which is also used on the farm. If further demand for this product justifies the expense, Mr. Reed plans to install an electric motor to operate the dragline.

An adjunct to the business is a tile yard, conducted on the premises by Charles Wilson, who owns and operates his business of manufacturing drainage and sewer tile entirely separate from the North Star Washed Sand and Gravel Company, but has a contract with this concern to provide gravel and sand as he needs it. This plant manufactures monolithic reinforced concrete tile to supply the demand in that vicinity for drainage and sewer tile in various sizes from 36 in. to 18 in. This plant is equipped with a one-barrel Rex batch-mixer, operated by a gasoline engine.



Tile yard, operated as adjunct to main plant

A return has been issued by the Ministry of Transport of Great Britain giving particulars of the gross receipts from the taxation of road vehicles for the period from December 1, 1928, to May 31, 1929 and new motor vehicles registered during the months of March, April, and May, 1929. The gross amount received for licences during the six months ended May 31, 1929, was £20,312,028.

Problems Confronting the Industrial Commission*

By HON. O. F. McSHANE
Commissioner, Utah State Industrial Commission, Salt Lake City

OF THE hundreds of problems presented to the Commission for solution, I shall mention but three. These three are chosen for the reason that they are all present in the conditions out of which industrial accidents arise. Society as a whole was formerly confronted with the solution of accident problems until a buffer service organization known as the Industrial Commission was provided to absorb the shock.

These problems briefly stated are:

(1) To make and enter a proper award when the right to compensation has been established.

(2) To re-educate and return to remunerative employment those who suffer a physical handicap due to industrial injury.

(3) To prevent accidents.

Taking these up in the order in which they are stated, the following matters pertaining to their solution should ever be kept in view:

It should be seen that injured workmen are adequately compensated during their period of disability. This does not only include a monetary remuneration for time lost but the furnishing of the best hospital, nurse, medical and surgical service which money can buy.

The principles underlying the compensation law do not contemplate paying a wage earner for his entire loss. This is sound for the reason that were injured workmen paid their full wage or a very substantial percentage of their full wage during a disability period due to injury, it would be a temptation for many men to develop the habit of getting injured and to prolong disability periods because they would rather have a major portion of their wages and loaf than their full wage and work. No law should provide so high a compensation benefit as to encourage men to malinger. There ought always to be a very strong inducement for men to return to work and that inducement should be his full wage. Neither should a law provide such a high rate of benefits as to cause employers to consider the revision of wage scales downward in order to escape what may be termed unreasonable compensation costs.

An agency should be provided for the rehabilitation and return to industry of injured workmen who sustain a permanent partial loss of bodily function. This should be done not as a matter of sympathy but because of its economic value to society. This agency should be properly organized and manned by people capable of observing critically the injured and placing him in the field of industry most suitable to his capabilities and most likely to draw forth his best efforts. Those in charge of such work should be experts fitted by natural endowment and by special training in their line. They should also be secure in their tenure.

I want to say now in commenting upon this point that no administrative body such as the Industrial Commission can function as efficiently and economically if subject to political control as when such interference is not had.

We see taxpayers' associations formed; we hold public meetings; we pass resolutions and spend a great deal of money in an effort to arrest the ever rising tide of the expenditure of public moneys; we witness the spectacle of political conventions, by formal declarations declare for economy and solemnly pledge the candidates of their respective parties to such a program. We see these same delegates go to their respective places of business and strictly apply these principles in their private affairs. Yet ninety out of every one hundred renege when party interest is injuriously affected by strictly adhering to them in public affairs. Until such time as business men stand four-square for the application of business principles in administrative matters, public service will be sub-standard and the cost will be exorbitant.

Such an organization properly set up and adequately financed is one of the best investments a state can make, for by its activities consumers are turned into producers and receivers of alms become providers.

It is true that not all can be rehabilitated—some because of the nature of their injuries, some because of their mental limitations, and some because of age; these, however, are questions for a skilled director to determine.

The third and last problem, but the most important of all, is that of preventing industrial mishap to workmen, the elimination of accident hazards and the education of workmen in avoiding accidents after they have been carefully selected and properly placed at their respective duties.

It seems to me there is no objection to the practice of making a thorough physical examination of applicants for employment before they are hired and put to work, provided the purpose of the examination is not to discard those who are substandard physically, but is for the purpose of intelligent placement after employment.

For example: There is no reason why a man with varicose veins should not be hired by an employer who has need of the services of an additional workman, but he should not be placed where

*Read at the Regional Safety Meeting, Ogden, Utah, September 27, 1929.

he is likely to bump his shins, causing the diseased veins to break down and result in varicose ulcers.

If a man is susceptible to conjunctivitis, he may be hired and become a useful servant but he should not be put to work in a dusty place. A man with a potential hernia may go for years without an actual descent of the hernia provided he be not put at heavy, strenuous work.

As this is a Safety Meeting, it is upon this last proposition that I wish to dwell. Noah Webster defines safety as—

"Freedom from whatever exposes one to danger or from liability to cause danger or harm."

A real piece of constructive work has been done when an accident has been prevented and a life saved. In comparison, an order for the payment of compensation is but a sickly gesture, in way of service. In order to accomplish a reduction in accident frequency there must be unity of action; safety begins at the top.

The management of an industry must not only be imbued with the importance of safety, but surcharged with the power to put over a constructive program. He must so organize his forces as to reach the great mass of workingmen under his charge. Unless the workingmen themselves can be reached and their cooperation secured, any safety program is doomed to failure.

Few accidents today are traceable directly to lack of safety appliances or to their faulty construction. The greatest safety factor in any plant, shop or mill is a careful workman. The hope of the future as regards a reduction in accident frequency is in the education of the workers themselves. That is the field in which the greatest activity on the part of the employer and bodies administering safety laws should direct their energies.

The manager, by the power of his convictions and his enthusiasm, must breathe the spirit of safety into every part of his entire organization. Do not put a man in charge of safety who doesn't actually live his work day by day. You can never make progress in accident prevention unless the head of the movement be convinced of both its propriety and economic value.

Your foreman is a most important individual from a standpoint of safety. He has the selection and placing of workmen; no more important functions are performed than these. He must be a close student of psychology. He must be able to analyze human nature to a point where he can properly select men. There are few men who cannot economically be used in some place in some employment. By wise and judicious selection and placement, labor shortages may be obviated before they occur, and turn-over reduced to a minimum.

Henry Ford finds it economic to employ in some of his plants one man in every three with some serious physical disability. This is more than his share, yet he makes it pay. If he can do this much, other captains of industry can certainly do less. This policy wisely pursued will make further immigration restriction possible; one hundred per cent of our man power utilized; hundreds of thousands of consumers who are today living upon charity can be made producers; in short, fewer mouths to feed and more hands to feed them.

No matter how intelligent the management, no matter how intelligently the employees are chosen, no matter how skillfully they are placed, no matter how favorable the working conditions may be, no matter how favorable conditions may be as to temperature, light and ventilation, no matter how splendidly the physical conditions of the plant may be kept up, accidents will occur because of the employee's own willful disregard of instructions and the safety of his person.

In addition to the spirit of down-right cussedness on the part of some employees, there are several mental factors in the individual, which, if not recognized and counteracted, will be responsible for a great many otherwise preventable accidents.

These mental factors have been classified by one student of the subject as:

Ignorance: Particularly is this the case among foreigners. Among such a class, it is difficult to give explicit instructions regarding their employment and the hazards to accidents which are present.

Inexperience: Such workmen are far more liable to accidents than the "old timers." Unfamiliar surroundings, anxiety and hasty instructions contribute to the accidents which befall this class.

Mental Limitations: There are several levels of intelligence. Some men need only one warning while others seem mentally incapable of correcting the accident habit.

Faulty Attitude: It is sometimes hard to secure cooperation in the acceptance and use of safety appliances; men are inclined to take chances. Particularly is this true if they consider themselves very skillful. Fatalism is also a serious factor in sustaining indifference and skepticism toward safety appliances.

Excitability: The highly excitable man is a menace to himself and others. With proper handling the excitable person becomes alert, and in a quiet, orderly workshop becomes as safe as the average person. Where there is confusion and tense accident hazard, the excitable person is a misfit.

Inattention and Lack of Interest in One's Employment: Boredom and distraction are the two leading mental states which lead to a distracted mind. The workmen may be bored for three reasons:

(1) The pay may not be enough to meet his necessary expense.

(2) His particular performance may seem to him trivial and unimportant.

(3) The job may be injuring his health.

The foregoing conditions occasion loss of interest and result in indifference and distraction. A general atmosphere of confusion and periods of hurry and stress keep a workman distracted when his attention should be on his work. Such conditions are usually due to bad scheduling.

In Conclusion, and addressing myself particularly to those who toil, if it were in my power to issue commandments to laboring men, I would select the following out of the hundreds which you may and do formulate in your own mind:

(1) Thou shalt rejoice in the knowledge of an unmaimed body and exercise great care to keep it such.

(2) Thou shalt avoid all preventable accidents that thy days may be long upon the earth.

(3) Thou shalt honor thy careful co-worker, for by following his example your best interests are served as were a choice of your employer and your fellow worker.

(4) Thou shalt keep thy mind on thy work that thy fingers may remain on thy hand.

(5) Thou shalt not take a chance; to do so is mockery and places the value of zero upon your life.

(6) Thou shalt not disregard warning signals; to do so invites injury, pain, privation and want, with its attendant evils.

(7) Thou shalt not take short-cuts over dangerous places.

(8) Thou shalt not engage in "horse play"; serious results follow therefrom and compensation balm in such cases is withheld.

(9) Thou shalt not rest or lean against railings, for death to Utah workmen has resulted therefrom.

(10) Thou shalt not fail to wear goggles while working in dusty places, engaged in babbitting or pouring lead, grinding, chipping, handling hot metals, "busting" rivets or bolts, or other work where there is danger of chips or splashes entering the eye.

You must, in your organized effort (and you must have organized effort if you hope to get anywhere) to reduce accident frequency, be careful that competition between your various units in the same plant or between your different plants does not become so keen as to result in a failure to report accidents. The temptation to not make reports of accidents, or to minimize the seriousness of those reported, will be the logical result of an over stimulation of an accident prevention campaign. When this condition prevails, your safety program has gone to seed. Disabilities slumbering, without proper medical care, are sure to appear in the future more serious in nature, more difficult to treat, more expensive and with less certainty as to cure. False statistics are reported upon which unscientific premium rates are predicated. Prolonged suffering, loss of members, and even death results from failure to promptly report every case.

In conclusion permit me to say that the "ballyhoo" of the shop Safety Meeting is valuable, inspiring and efficient only when sustained by a regular program of safety and supported by careful inspection and competent safety engineering practices.

The formation of regular safety organizations by the management without real interest other than the securing of credit on schedule rating is a hollow mockery and is discredited by the deplorable accident toll due to lack of managerial contact and necessary support of a well planned constructive safety program.

Magazines for Explosives Storage

From a valuable booklet issued by the Hercules Powder Company, we reproduce the following suggestions about building explosives magazines.

In practice, the construction of magazines differs materially. Many are built of concrete, bricks, or large blocks of stone. There is probably only one objection to these materials; in case of accidental explosion, large parts of the magazine itself may be hurled through the air as missiles. More frequently, magazines are built of a light framework covered with corrugated iron or double walls filled with sand.

The Bureau of Mines has built a cement-mortar magazine which it recommends. The concrete of the foundation consists of one part cement, three parts sand, and five parts gravel. The cement-mortar of the walls is one part cement to six parts coarse sand. Besides offering maximum protection in other respects, the magazine is protected against lightning by having its entire roof and all sides covered with galvanized sheet-iron, all parts of which are grounded with ½-inch iron rods. These rods extend from the four lower corners of the building and are attached to properly laid earth plates buried well below the moisture line. Soft-burned brick is also a recommended material for building magazines.

In selecting a magazine site, advantage should be taken of any natural protection offered by hills and timber. Sandy soil is to be preferred to rocky ground for, in case of accidental explosion, the former will reduce the distance at which damage will be done.

Where an accidental explosion would endanger life or nearby property, it is often desirable to erect barricades on the sides where damage may be done. Barricades are constructed of earth or sand from which all large stones or other projectile material has been removed. The mounds are usually 3 feet higher than the highest point of storage in the magazine. They are 3 feet wide at the top, with a natural slope on both sides, the inner slope reaching to within a few feet of the sides of the magazine.

Diesel Engines — Their Present and Possible Applications in the Pit and Quarry Industries—IV

Discussing, Describing and Illustrating Practical Applications of Oil Engines and Pointing to Opportunities for Saving by the Use of This Power

By J. O. DURKEE

IN THE three former sections of this series of articles, different types and classes of engines were described, diesel-operated power plants were discussed and the advantages of diesel-operated stone plants were pointed out. Sections discussing hydraulic dredges, diesel-powered towboats and the application of diesel power to excavating machinery have been included in the former discussions. These different fields were discussed from the point of view of an operating engineer with the thought that the operators in the fields will consider these concrete examples and thereby be assisted in their studies of production costs and increased efficiency.

As we proceed in this series of articles, we are investigating different uses for this type of power and passing them to the readers. While the diesel engine has almost unlimited opportunities in the pit and quarry industries, yet natural conditions and many other factors pertinent to plant engineering should be considered. For that reason, this series of articles has been more concerned with examples of the real work being accomplished together with short descriptions of such operations, rather than discussions in the abstract and making unsubstantiated claims for what may be accomplished by any type of machine.

The Moore Speedcrane, built by Manitowoc Engineering Works, due to the roominess of its cab, is readily adaptable to the use of a diesel engine.

Where this installation is made, the Atlas-Imperial, four-cylinder diesel engine, 7-in. bore by 8½-in. stroke, mechanical injection, 4-cycle vertical type, having enclosed oil-tight crank case, overhead valves and forced lubrication, is used. This engine is rated at 80 h.p. at 650 r.p.m.

The fuel injection system is the constant pressure type, the fuel being admitted to the cylinders under high pressure thru mechanically-operated injection valves.

This system should not be confused with the systems using high pressure blast air to spray the fuel into the cylinders, necessitating a cumbersome expensive power consuming compressor.

Lubrication of the engine is accomplished by a dual system. The primary system consists of a mechanical ratchet driven forced feed oiler which supplies oil to the cylinder walls. New oil is used in this oiler and the excess, after being caught in the oil-tight base, is the "make up" oil for the secondary system.

The secondary system supplies oil under pressure to all main bearings, crank bearings and wrist pins. The pressure is maintained by a pump which forces the oil through drilled passages from the middle of the main bearing diagonally through the middle of the journals and the webs of the crank shaft and passes to the middle of the crank pins and thence through hollow connecting rods to lubricate the piston bearings.

All the oil pumped through these bearings is collected in the crank pit, flows to a sump through a strainer, is pumped from the sump through a cooler to the filtering tank and returned to the bearings by a positive pressure pump. This pressure may be adjusted at the will of the operator.

This engine is of the full diesel type and ignition is accomplished solely by means of the heat of compression. The starting valves are mechanically actuated by means of a convenient handle.

A small inbuilt air compressor driven off an extension of the fuel pump shaft is provided to replenish the starting air supply while engine is operating. As an emergency unit for supplying air for starting there is provided a small combination consisting of a gasoline engine and air compressor of block construction. This unit is provided with high tension magneto, impulse starter, starting crank, built-in circulating water pump, and a one-gallon brass gasoline tank.

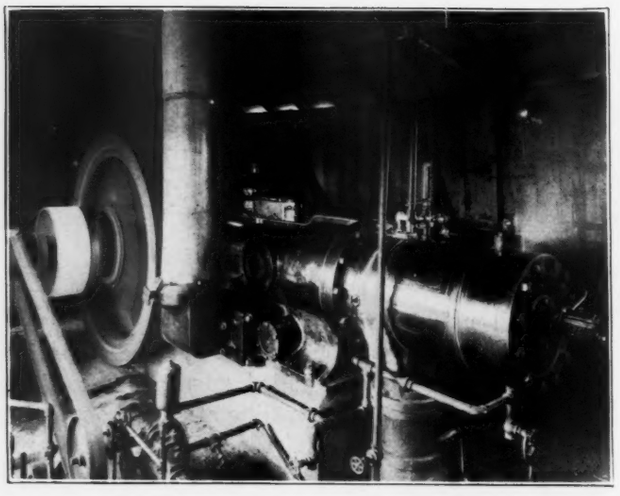
The power take-off consists of a "Twin Disc" clutch and drives to a standard jack shaft through a silent chain drive.

This engine may be had as standard equipment, at extra cost, in a Moore speedcrane, speed shovel, speed dragline, or speed Trenchoe.

Rockport Stone Installation

An interesting example of a small crushed stone plant which is entirely driven by a semi-diesel engine is the Rockport Stone Company at Columbus Grove, Ohio. This plant has been in operation about 6 years and has a capacity of 160 tons per day.

The machinery consists of an Austin hoist which hauls a 1¼ yd. steel car up the incline from the quarry to the plant, the Allis-Chalmers Gates No. 3 primary crusher, the Austin 3 ft. by 8 ft. revolving screen, the Gates No. 2 recrusher and a bucket elevator. These are all belt or chain driven from a line shaft which is belt driven by a "Primm"



Primm semi-diesel 75-hp. low compression horizontal engine operating plant of Rockport Stone Company

75-hp. low compression, horizontal semi-diesel engine. A small air compressor and pump are also driven direct from the engine.

This engine has been in operation since the plant was built, during which time 160,000 tons of crushed stone have been produced. Practically no repairs have been necessary in that time, the owners estimating the total maintenance expense at less than ten dollars.

Operating at full load all day the engine operates with a fuel and oil cost of about $2.00 per day, using 3½ gallons of fuel oil per hour.

Diesel Powered Locomotives

On behalf of the diesel-electric drive for locomotives, it has been pointed out that the diesel engine might be damaged by the shocks incident to this service if connected to the drivewheels by hydraulic or frictional gearing. While special conditions require special equipment and there are probably conditions in pits or quarries where a diesel-electric locomotive is to be preferred, yet as a general proposition this particular statement is absurd because the gear ratio between the diesel crankshaft and the driving axles of the locomotive is rarely less than 3:1 and is more frequently 10:1. A shock transmitted backwards through such a gear reduction must be very severe to have any appreciable effect on the engine. Diesel engines are subjected to much rougher usage than directly connected to a locomotive when their speed is varied through the critical range of torsional oscillations and they are not damaged so long as they are not required to operate for extended periods at or near critical speeds. That England is making marked progress in the application of oil engine power to the pits and quarries is attested by the included statement taken from a Trade Note appearing in *The Quarry Manager's Journal*, although the engine described is not a true diesel as defined by most engineers.

"The most obvious advantages of the diesel engine are: Firstly, the very low cost of fuel oil compared with petrol, and secondly the absence of such a delicate instrument as a magneto. Against these advantages, however, difficulties were originally encountered which made the diesel engine unsuitable for general use, namely: Imperfect combustion due to the difficulty of controlling the quantity and moment of injection of the fuel. Difficult starting due to the high compressions commonly used and imperfect fuel mixture. Excessive consumption of lubricating oil due to the use of the two-stroke crankcase—scavenging type of engine.

"It is claimed that with the Montania diesel locomotive, manufactured under the "Acro" license, and marketed by Messrs. William Jones, Ltd., 154/5, Upper Thames Street, London, E. C. 4, these disadvantages have been overcome.

"The injection of fuel to each cylinder is controlled by a mechanically-operated pump, the product of Messrs. Robert Bosch, which, when once properly set, gives the correct quantity of fuel at a point in the cycle of the engine as accurately timed as the spark given by a magneto. This, combined with the unique construction of the combustion chamber, insures so nearly complete combustion that these engines can even be run indoors for a period without danger from fumes.

"The starting difficulty is completely eliminated by the effective half compression device, and in the larger models by the fitting of electric starting motor as standard. In all models starting is effected by the use of touch paper, which is inserted, smouldering, into the cylinder and obviates the use of any such tiresome apparatus as a blow lamp, but this is necessary only for the first start in the morning. The engine works on the four-stroke principle, and lubrication is similar to that of a petrol engine. The consumption of lubricating oil is guaranteed to be not more than 3 per cent of the fuel oil consumption.

"The engine speed is controlled by a governor to 1,200 r.p.m., and it can be relied upon to run efficiently and steadily for long periods without expert attention.

"As any practical engineer will realize, however, there is much more in the design of an efficient locomotive than the inclusion of a suitable power unit. The 'Montania' locomotives have 30 years' experience behind them in the handling of all types of steam, petrol and crude oil locomotives, and points such as relation of weight to horsepower, strength, type and rotios of gearing, wheelbase and distribution of weight have received the utmost attention which has resulted in the production of a locomotive of maximum reliability, efficiency, and economy in running.

"The 'Montania' diesel locomotive is made in three sizes, viz:

Type	Cyds.	HP.	Weight	Haulage
R. L. 1	Single	10	2¾ tons	47 tons on level
R. L. 2	Double	20	5 tons	83 tons on level
R. L. 4	Four	40	11 tons	210 tons on level

"In all the above locomotives the gauge can be quickly altered between reasonable limits to suit existing special gauge tracks. They are four-wheel coupled, and while being absolutely steady in running, can negotiate comparatively sharp curves.

"The gears are constantly in mesh, and change of speed is effected by means of ferodo-lined cone clutches. The reverse is operated by means of dog clutches. The drive is by double roller chain from gear box to front axle, which is in turn coupled to the back axle by single roller chain.

"The very low running cost of these locomotives may be judged by the results of exhaustive tests carried out under average working conditions. For the type R. L. 2 it was found that for an average 8-hour day, the fuel oil consumption was 6 gallons=2/—; lubricating oil, 2 pints=1/—, total 3/—."

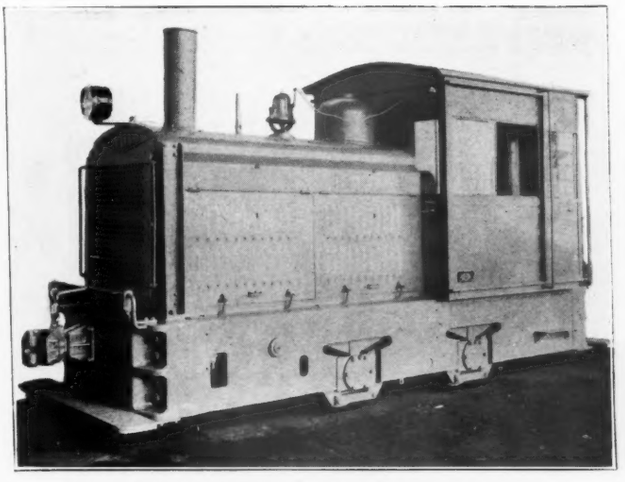
Again we quote from the *Quarry Managers Journal,* which under the caption "A Locomotive that Thinks for Itself" states:

"Visitors to the Royal Show at Harrogate, this year, had the opportunity of inspecting a unique new type of Internal Combustion Locomotive. It was on Keer Stuart & Company's Stand No. 216, and is remarkable for two things.

"Firstly, it is fitted with a Diesel Engine burning crude oil at less than 4d. a gallon; and secondly, it is the first locomotive in the world to make use of the new Robertson Infinitely Automatic Variable Gear. What this latter means is fairly well summed up in the makers' claim that it is "a locomotive that thinks for itself," and really, after seeing it run, one must admit that such a claim is justified. For the gear fitted to this locomotive changes itself up and down in accordance with the load that is put upon the locomotive; the work of the driver being reduced to that of handling the engine throttle and the brake.

"Like most worth-while inventions, the gear, although doing a very complex job, carries it out in a very simple manner. Moreover, it has a minimum number of working parts, and most important of all, for over 90 per cent of its life, all these parts are locked solid and do not move.

"Experience with this gear, previous to its being adopted for the K.S. locomotive shows, that after a hundred thousand miles of hard work, there is scarcely sufficient wear on the friction surfaces to be measureable. Even so, these, the only wearing parts in the gear, can be replaced at an expenditure of a few shillings, and in less than half an hour.



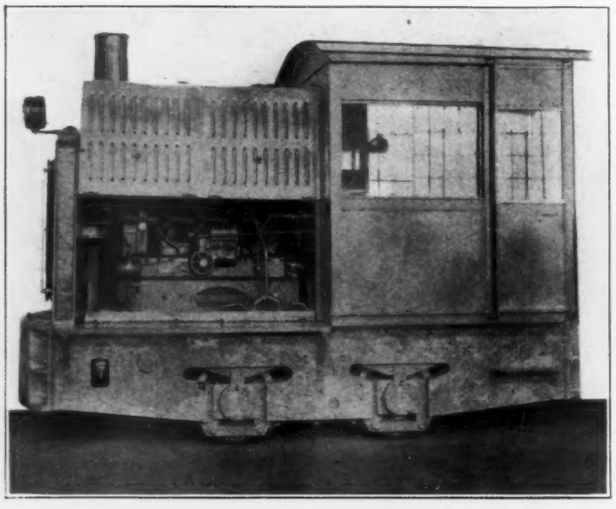
A Whitcomb diesel-operated locomotive

"In addition to its transmission, the K.S. diesel locomotive is also characterized by having a prime mover that is extremely economical. It uses, actually, rather less than ½ lb. of fuel oil per b.hp. hour; which means that on an average day's work the cost of the fuel will come to not more than 2/3. The makers claim with this locomotive that with fuel oil at £3 10s. per ton—a figure at which it is readily obtainable to-day in many places—you would have to buy petrol at 1.86 pence per gallon to compete, and that, even if fuel oil rises to £7 a ton,—that is double its present value,—you would still have to buy petrol at 3¾d. per gallon to equal the K.S. locomotive in economy.

"In these days, when every farthing that can be saved is so urgently needed for the development of business, figures such as these cannot be lightly passed over."

The Geo. D. Whitcomb Company, which manufactures six different types of locomotives includes diesel-driven locomotives from 6- to 30-tons as well as locomotives, with diesel engines in the oil-electric types. These locomotives are of the same general design as the gasoline powered locomotives built by the Geo. D. Whitcomb Company, the smaller sizes being of the one-piece cast unit-frame type, while the larger locomotives have a four-piece cast frame, consisting of two heavy side castings and end bumpers. Lugs are cast integral with the frame and support the engine and transmission. The frames are carried on heavy semi-elliptical springs and each locomotive is built with a cross-equalizer.

In these models, the Fairbanks-Morse 2-cycle engines of the heavy duty, airless injection type are used. No carburetors or magnetoes are required as these engines operate on the full diesel cycle and ignition is obtained solely by the heat of compression. A dual lubricating oil system is provided so that the injection and governing system is supplied from a clean oil pump and the cylinders and



Whitcomb diesel locomotive with engine in view

crankshaft are supplied by a force feed mechanical lubricator.

The power of the engine is transmitted to the clutch and from the clutch to the upper shaft in the transmission; from upper to lower shaft through speed change gears and from the lower shaft to the cross or jack shaft by a bevel pinion and two bevel gears. On the jack shaft are two sprockets which drive from the jack shaft to the rear axle. By using a double chain drive, an equal pull is secured, which is always in one direction. The drive from the rear axle to the front axle is by roller chain and this again is in the same direction. In this manner all four wheels act as drive wheels, operating as a single unit.

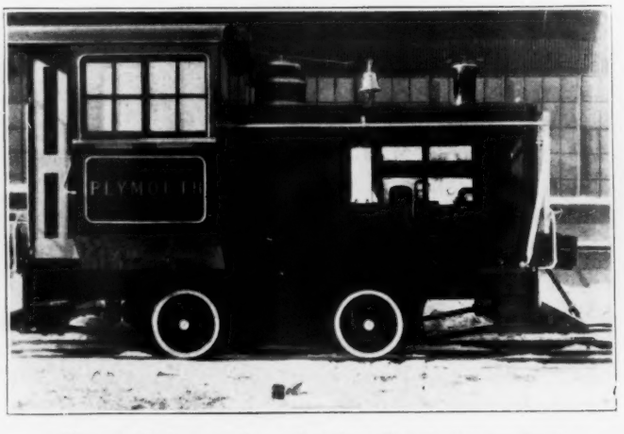
Early in 1926 The Fate-Root-Heath Company began the study of applying a diesel engine to an industrial type locomotive. Considerable development work was done and several sizes of locomotives with various types of diesel engines were planned.

In May, 1927, the first order was received, calling for three 10-ton, 4-wheel locomotives, equipped with Atlas Imperial 4-cylinder diesel engines, 6½-in. bore by 8½-in. stroke. These engines are rated by their manufacturer to develop 70 hp. at a speed of 600 r.p.m. These locomotives were placed in service at the Livermore (California) gravel plant of The Kaiser Paving Company, each locomotive hauling a train of eight gravel cars a total distance of about 1½ miles from the gravel pit to the storage bunkers. A good part of this haul is up a 3 per cent grade and the locomotives soon demonstrated the fact that horsepower rating, as applied to engines in diesel locomotives, is very likely to prove misleading. Because of the high torque developed by the diesel engine when operating at slow speeds, the locomotives demonstrated a remarkable ability to start and haul over long severe grades, much greater loads than a gasoline locomotive of the same size and horsepower, and the increase in hauling capacity over any other type of locomotive was still greater than the increase over the gasoline locomotives. These three locomotives have been in service over two years, operating part of this time on a 24-hour daily schedule, and have shown high operating efficiency, low maintenance costs and a very low cost for fuel.

The next development was that of a 30-ton locomotive of the 6-wheel type, this locomotive being equipped with an Atlas Imperial 6-cylinder diesel engine, 7½-in. bore by 10½-in. stroke; this engine rated to develop 155 hp. at 500 r.p.m. Two locomotives of this model are in service at quarries in California operated by the Calaveras Portland Cement Company and the Monolith Portland Cement Company. In both of these installations, the work consists of hauling rock from the quarry to the mill.

In June 1928 the Plymouth Locomotive Works completed tests on a still larger mechanically-driven diesel locomotive, this being a 60-ton size with two 4-wheel swivel trucks, driven by a Foos Model L, 8-cylinder diesel engine, 8½-in. bore by 11-in. stroke, connected through a heavy duty double disc clutch to a 4-speed gear transmission, and through this, by means of propeller shafts fitted with universal joints and splined couplings, to bevel gears driving the outer axles in each truck, then back to the inner axles by means of connecting rods driven by the wheels.

Although the models now developed and tested had all proven themselves admirably fitted for any work in their class, there was still a need for lightweight, fast-accelerating locomotives for switching service and short hauls, and for this purpose a range of sizes from 15- to 30-ton in both 4- and 6-wheel models was developed. In these, a higher speed, lighter weight diesel engine was required, and for a period of approximately two years the Buda M. A. N. diesel engine has been tested in various locomotive applications. Five models of



Plymouth locomotive, showing diesel power plant

Diesel operated shovel loading truck

Plymouth 30-ton diesel locomotive, owned by Calaveras Cement Company

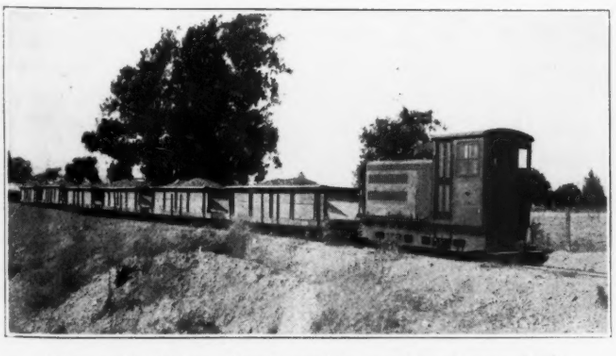
Plymouth diesel locomotives are now made in this range of sizes, equipped with three models of Buda M. A. N. diesel engines.

The diesel engine for automotive service has made rapid strides in the past few years and as the engines have been developed, Plymouth has kept pace with locomotive development. Plymouth diesel locomotives are now built in a range of sizes from 10- to 60-ton, in 4-, 6- and 8-wheel types and driven with either 4-speed gear transmission or electrically with generators direct-connected to the engines and separate motors geared to each of the axles.

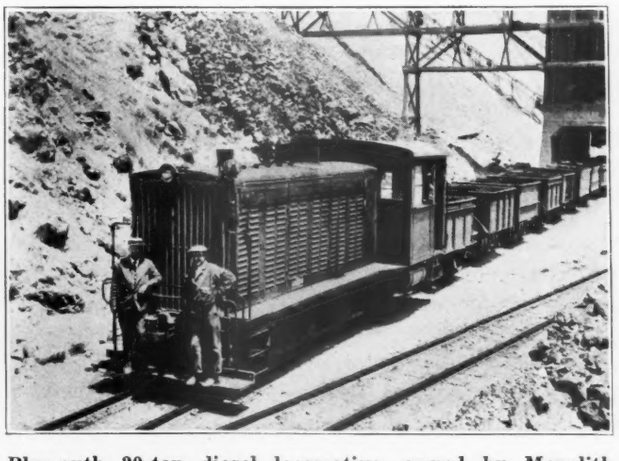
Trucks

According to M. Gibbons, there have been no commercial applications to trucks in this country, although in Germany they have been in use for a number of years, and more than 100 are in regular service. One builder of high-speed diesels in this country has installed one of his engines in an ordinary four-ton truck. This was accomplished without extension of hood or change in radiator. In competitive service for the past three years and in the hands of regular truck drivers and at temperatures ranging from —10 deg. F. to 95 deg. F., this truck has shown a fuel-consumption ratio of 3 to 8 as compared with a similar gasoline-equipped truck and a lubricating-oil consumption ratio of 3 to 4. Or with gasoline at 20 cents and diesel oil at 6 cents per gal., the fuel costs are as 1 to 9. The diesel-engined truck is particularly effective on the hills as its speed-torque characteristic is much better at low speeds than that of the gasoline engine. This results in less gear shifting and in smoother operation. The distance covered per gallon was 10½ to 11½ miles.

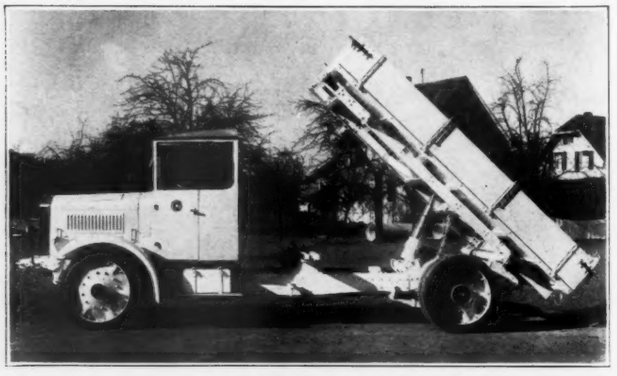
While not exactly a commercial application, the following record should be included. A 5½-ton diesel-powered truck made a round trip of 1500 miles from New York to Detroit. This truck was motored by a 70-hp., 6-cylinder, 105-mm. bore by 165-mm. stroke diesel, running at 1300 r.p.m. (18.6 m.p.h.). It consumed 115 gal. of furnace oil and 1 gal. of lubricating oil, or about 13 miles per gallon of fuel. The engine showed a fuel consumption at full load of 0.456 lb. per b.hp.-hr. In handling, both on the open road and in congested city traffic, flexibility equal to that of the usual gasoline truck was readily had, while on the hills the diesel was noticeably better than a similar gasoline-powered unit.



Plymouth 12-ton diesel used in sand and gravel pit of the Kaiser Paving Co., Oakland, Cal.



Plymouth 30-ton diesel locomotive, owned by Monolith Portland Cement Company



Mercedes-Benz truck with hydraulic dump

Diesel Operated Well Drills

In a paper, "The Well Drill Method of Boring and Blasting Limestone and Other Rocks," by Stanley Millington, read before the Annual Conference of the Institute of Quarrying at Brighton, England, and awarded the Maybury Gold Medal and Fellowship, there is some pertinent information on prime movers for well drills. Under the subhead, "Type of Prime Mover," Mr. Millington states:

"(a) Steam. (b) Oil. (c) Electricity. (d) Compressed Air.

"If the machine be of the traction type, then the horsepower of the prime mover will be required to be about 18/20 b.hp., and if of the non-traction type then about 12 hp. will be sufficient, although it will be found that about 10 hp. will be required for the actual drilling, so that for the purpose of comparing actual power costs it will be quite safe to use this figure.

"Systems (a) and (b) can be considered to be independent units, that is, they do not depend upon any outside source in any way whatsoever for the supply of their power.

"Systems (b) and (c) depend upon some central source of power house for their supply.

"The first two classes (a) and (b) have several advantages over (c) and (d) because they are independent of power cables, air lines and power stations; if the quarry is stopped or the power plant under repairs, drilling can still be carried on, a double shift can be worked without the necessity of keeping the power plant and its attendants working (this latter item would of course not apply to system (c) if electricity is bought from some external supply company in bulk).

"In most cases, however, local conditions are such that one kind of power proves to be the most efficient for that particular quarry. Unless, however, there are some exceptional local conditions, the steam (a) system is never to be recommended, due to both the cost and trouble of getting coal to the site and also the laying of water mains; further, the driller's assistant must be capable of looking after a steam boiler, and his attention will be so much taken up with this task that he will not be available to render any assistance to his mate, and there is the continual complaint of 'not being able to keep steam.'

"The oil or gasoline engine system (b) has many points in its favor, and many advantages over the steam system.

"Fuel can easily and quickly be brought to the site, little or no water is required in comparison, no lost time waiting for steam to rise; after starting up, no further attention is required by this type of engine, and so the driller's mater is free to render any assistance he may be required to render to his mate."

Conclusions

In conclusion, if this series of articles on diesel-operated machinery has created some thought, the end for which we have striven has been accomplished. This discussion has brought out the practical side of the uses of diesel engines. It has described and illustrated many of the successful operations and pointed out methods of using them to reduce operating expenses.

It is not believed that diesel engines are a panacea for all operating difficulties, nor can they be used to replace all of the prime movers now being successfully operated. There are numerous instances where a plant is operating on approximately a full-time basis and the minimum demand charge of central power plants is not a great overhead to carry; in cases where a new plant has been installed, it would materially increase the depletion, depreciation and interest charges to make radical changes, until the plant has become obsolete.

As the discussion indicates, there are numerous places where a diesel engine is the logical source of power. By using diesel engines, separate units of the plant may be used without the expense of operating a large power plant. These engines may be used as separate units to operate well drills, compressors, pumps or any machine that should operate during periods of general plant suspensions.

It is believed that enough cases have been cited to induce thought and discussion of these latest and efficient prime movers. However, careful thought and consultation with experienced engineers should serve to outline plans for all producers in developing new fields or in rebuilding obsolete plants. Many times, the replacement of almost new machinery has shown a satisfactory profit. This being true, it is well to install the machinery most suitable for the functions to be performed. Careful consideration and systematic surveys will tend to organize sufficient facts from which to assure a successful and profitable plant.

Combination of Lime With Ingredients of Argillaceous Rock in Progressive Heating of Raw Cement Mixture*

A Report from the Cement Technological Institute of the Technical High School in Berlin on Investigations

By HANS LORENZ and DR. HANS KUEHL

[*This report is a rather long article and contains considerable interesting information. However, it is not practical to reproduce the article in full here and the translator has accordingly taken the liberty of combining paragraphs into sentences and omitting such sections as he deemed unnecessary for the proper understanding of the work without interrupting the continuity of the exposition. The article has accordingly been paraphrased and in parts rewritten so as to conserve space.—Trans.*]

CHEMICAL methods are employed in this investigation to arrive at a complete explanation of the chemical constitution of portland cement. These methods were selected in preference to the mineralogical method, as the latter has failed to accomplish the desired result. In order to show why this selection is made, the authors review the mineralogical researches carried out within the past years.

It is pointed out that the results gained from these investigations have not agreed with the experiences of practical cement chemistry. Kuehl also points out that portland cement does not consist of tricalcium silicate, dicalcium silicate and tricalcium aluminate as the main ingredients according to American investigators. The work done by Jaenecke on the ternary system, lime-silica-alumina, is also reviewed. The author believes that the presence of jaeneckite in portland cement is substantiated and that this compound plays an important role in the structural constitution of portland cement clinker. The author also mentions the unfortunate condition that Jaenecke has himself expressed doubt as to the actual existence of jaeneckite in the clinker. He points out that the best composition of a portland cement, as established by this investigator, does not agree with practical experience. He believes that the cement which contains 21.3 per cent silica, 8.0 per cent alumina and 2.0 per cent iron oxide must contain more than 63.7 per cent of lime, if it is to be designated as the best cement composition.

The author also calls attention to the investigations carried out by Walter Dyckerhoff which have attained the same degree of scientific value as those carried out by American investigators and which have afforded some new and very valuable bases for solving the clinker problem.

Nevertheless, the author has again found that these experiments and the conclusions drawn from them, particularly due to the fact that they were carried out on chemically pure compounds of lime, silica and alumina, have not been sufficiently well substantiated by actual experience in the mill laboratory. He points out that when Dyckerhoff assumes alite to be a dicalcium silicate which has been enriched with lime, the assumption is just as faulty from the standpoint of the practical cement chemist as when Jaenecke assumes that alite is a mixture of dicalcium silicate and jaeneckite. The writer believes that the reason for this is in both cases that the experimenters did not try to coordinate their results obtained from purely scientific experimentation with the requirements of practical cement chemistry, and particularly in that they sought to forget the presence of iron oxide in the clinker.

Even chemists and technologists in the cement industry in its early days understood the importance of the presence of iron oxide as far as the mechanism of sintering the clinker was concerned, although they may not have known that iron oxide is not only of great importance as far as cement burning is concerned, but also, as the author believes, must be called the key of the solution of most scientific problems connected with cement manufacture and cement constitution.

When Dyckerhoff determined for example that dicalcium silicate forms so rapidly at temperatures of 1,100 degrees C that this reaction assumes practical importance, and when he also found that monocalcium aluminate is formed at rates, which are of practical significance, at temperatures between 900 and 1,000 degrees C, then the application of these conclusions based on the pure compounds to the reactions, which occur in the heating of raw cement mixtures containing iron oxide, is inadmissible. There is no doubt that new compounds of calcium silicates and calcium aluminates are formed during the heating of the raw cement mixture at very much lower temperatures than are required for the formation of these substances from their pure components. Monath has shown not so long ago (see *Revue des Materiaux de Construction*, 1928, number 3) that new calcium silicates and calcium aluminates are formed at a tem-

*Zement, 1929, 604-611.

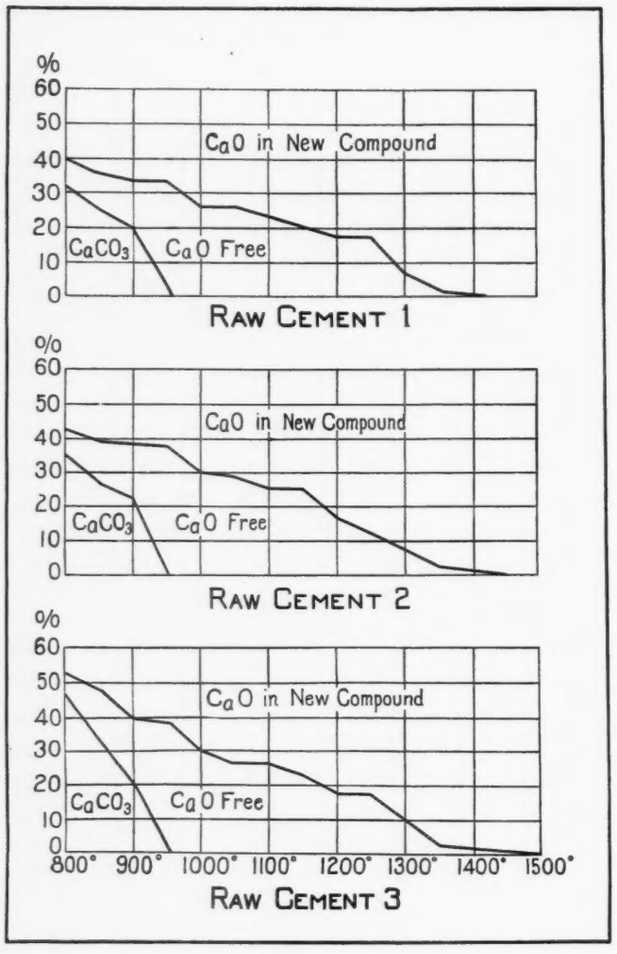


Fig. 1

perature of 730 degrees C, and that these new compounds exist in appreciable amounts in the clinker at temperatures varying between 800 and 850 degrees C. The reactions, which take place in the raw cement mixture at such low temperatures, have, however, remained unintelligible up to the present time, even when the observations that Dyckerhoff carried out on the chemically pure materials, are used in the attempt to explain them.

Hans Lorenz under the direction of Dr. Kuehl was accordingly assigned to the task of measuring the free lime in the clinker at different burning temperatures in order to obtain some information on the progress of combination of the lime with the ingredients of the argillaceous rock as this process actually takes place in heating the raw cement mixture in the cement kiln as it is used in the manufacture of portland cement on a large scale. Mr. Lorenz used the same methods that Monath employed, with the sole difference that the measurement of temperature by means of Segar cones was substituted by its measurement with the aid of the platinum-platinum-rhodium thermocouple. Furthermore, the temperature was raised to much higher points in order to obtain data on the processes that take place before and during sintering. Whenever possible, conclusions were sought regarding the constitution of portland cement clinker and in particular the constitution of alite.

The methods used by White and Emley (see *Journal of the Society of Chemical Industry*, year 1909, I, page 5) were employed for the determination of the free lime in the portland cement clinker. One of these is satisfactory for qualitatively testing the presence of free lime and the other for determining it quantitatively.

According to the White method, a small quantity of powdered cement clinker is mixed with a solution of phenol in nitrobenzene, which contains a trace of water, and is rubbed into a paste. Then it is examined under the microscope between crossed Nichols prisms. If free lime is present, then needle-shaped crystals possessing high double refractive properties are formed. The speed of this reaction is quicker the larger the quantity of free lime present, so that some conclusion can be drawn in an approximate manner regarding the quantity of free lime present from the time that is required for the appearance of the first needles after the mixture was prepared to the end of the reaction. Thus for example if no small crystalline needles have been formed at the end of fifteen minutes, then free lime is not present in the clinker.

According to the Emley process, from 0.2 to 0.3 gram of cement is mixed with six cubic centimeters of glycerin in thirty cubic centimeters of absolute alcohol in an Erlenmeyer flask, and the mixture is heated to boiling, whereat free lime forms a glycerinate with the glycerin. The mixture is then titrated with n/5 alcoholic ammonium acetate solution with phenolphthalein as indicator until on renewed heating and standing a red coloration no longer is formed.

In order to determine the suitability of this method for the purpose in mind, a cement which showed no free lime reaction was mixed with two, five and eight per cent of pure quicklime in a porcelain ball mill. Each of these mixtures was tested three times and the results are given in tabulation No. 1:

TABULATION NO. I.

	Cement with 2% Lime	Cement with 5% Lime	Cement with 8% Lime
First titration	2.15%	5.08%	8.10%
Second titration	1.95%	4.93%	7.92%
Third titration	1.90%	4.83%	7.96%
Average	2.00%	4.95%	7.99%

The starting material in the determinations of tabulation No. I consisted of three raw cement mixtures of quite different composition. These three mixtures were analyzed and the analysis on the ignited substance gave the results shown in tabulation No. II:

TABULATION NO. II.

	Cement Mixture 1	Cement Mixture 2	Cement Mixture 3
Silica	19.35%	22.61%	22.23%
Alumina	8.32%	5.92%	3.44%
Iron oxide	7.21%	3.05%	3.22%
Lime	62.17%	66.38%	67.62%
Magnesia	2.66%	1.70%	2.57%
Sulphur trioxide	0.29%	0.34%	0.92%
Hydraulic modulus	1.79	2.10	2.34
Silicate modulus	1.26	2.52	3.44
Iron modulus	1.15	1.94	1.07

Cement mixture 1, in table No. II, is poor in lime, has a low silica content and a high iron oxide content. Cement mixture 2 has a moderate lime content, as is common in the general practice of portland cement manufacture. Cement mixture 3 contains a larger proportion of lime, which is close to the allowable maximum. It differs from the two other cement mixtures in that it contains comparatively little alumina.

The burning experiments were carried out within the temperature range of 800 to 1,500 degrees C. in stages of fifty degrees in a Heraeus tube furnace with platinum winding according to a process which the author described in records of the German Portland Cement Manufacturers' Association, 1926, page 46. (This method is also described in *Tonindustrie Zeitung*, 1929, page 374). All the temperature measurements were made with a calibrated platinum-platinum-rhodium thermo-couple.

In finely pulverized raw cement mixture was moistened with water and made into rods which were of the thickness of an ordinary lead pencil. These rods were dried, wrapped in platinum foil and then heated in the furnace. The temperature was raised slowly and in the same manner in each experiment and then maintained each time for twenty-five minutes at the desired point. After the end of the burning process the current was turned off and the clinker, after being allowed to cool off to a certain degree but still in the faintly incandescent condition, was taken out of the furnace. A current of air, free from carbon dioxide, was passed through the furnace in all the experiments during the heating operation, in order to exclude the possibility of the clinker absorbing carbon dioxide from the atmosphere.

Although there was hardly any doubt in the mind of the experimenter that this burning process was reproduceable and admissible, nevertheless a series of tests were made and parallel experiments carried out, revealing the fact that the individual experiments agreed well with one another. Differences were found in the sole instance when the cement was burned under constant experimental conditions at a temperature in the neighborhood of 900 degrees C. These differences were due to unavoidable experimental errors. The reason for this is apparently that at this temperature the dissociation pressure of the calcium carbonate attains atmospheric pressure and the reaction is very rapid with violent evolution of carbon dioxide gas.

Differences were found in a single instance at a temperature of 1,250 degrees. A very vigorous reaction sets in within this temperature range, as has been observed before by Nacken (see *Zement*, 1920, page 75, and *Zement*, 1929, page 246) and is substantiated by these experiments, so that the speed of the reaction renders difficult the conception of a definite phase in the reaction picture.

The curves, which are shown in figure 1, give a clear idea of the course of the reaction based on the determination of the free lime and of the carbon dioxide at different temperatures. One thing that is striking is the similarity between the three curves for all three raw mixtures. This fact is all the more remarkable because the composition of the raw cement mixtures varied so widely. It is, therefore, not too radical an assumption to make that these figures are characteristic for all portland cement raw mixtures.

A noteworthy fact is that a considerable quantity of carbon dioxide is evolved from all three mixtures at a temperature of 800 degrees C, which amounts to as much as 50 per cent of the entire carbon dioxide generated. A fact which is even more interesting is that at a temperature of 800 degrees C. very considerable quantities of the limestone have been converted into new compounds, and that at a temperature of 950 degrees C., that is above the dissociation temperature of calcium carbonate, almost half of the limestone has been consumed in reaction with the ingredient of the argillaceous rock. There is accordingly no single phase during the entire burning process in which the total amount of available limestone is even only approximately set free in the raw cement mixture!

Further study of the curves in figure 1 reveals interesting information. All three curves clearly show sharp slopes between 950 and 1000 degrees C. This indicates that a particularly vigorous combination of the lime with the constituents of the cement rock takes place at that time, after the last of the carbon dioxide has disappeared from the raw mixture. This is the phenomenon which agrees best with the law of mass action. In the moment, when the content of free lime in the mass quickly rises, the reaction between free lime and the cement rock is correspondingly accelerated.

The curves show a second steep decline in all cases between 1,250 and 1,350 degrees C. This is the region wherein a marked shrinkage of the mass takes place due to melting of a part of it. This reaction takes place so vigorously that at approximately 1,350 degrees C almost the entire quantity of lime has been combined. The resi-

dual amount is then slowly absorbed as the temperature rises, so that when 1,500 degrees C. is reached, free lime is no longer present, even in raw cement mixtures that contain large percentages of lime.

The temptation was very great to use these lime-reaction curves to study the individual reactions that take place during the burning of cement and to form some conclusion as to the order in which the different calcium silicates, aluminates and ferrites are formed. Although experimental research may be considered to be absolutely essential for this purpose, nevertheless we used a mathematical method for determining the distribution of the lime at various temperatures from 800 to 1,500 degrees C. (This method is described in full in the original article but cannot be reproduced here due to lack of space.—Trans.)

The author is of the opinion that those compounds, which were obtained by Dyckerhoff at high temperatures from pure substances, can be obtained at much lower reaction temperatures from the technical raw cement mixture. Dyckerhoff has shown that of all the compounds which can be formed between lime, silica and alumina, the one that can be formed easiest and at lowest temperature is monocalcium aluminate. The author has accordingly assumed in his calculations that the first reaction between lime and the ingredients of the cement rock results in the formation of monocalcium aluminate.

There is considerable question as to which reaction is second. According to Dyckerhoff, monocalcium aluminate is comparatively easily converted into higher aluminates. However, inasmuch as the consumption of lime even in the lowest temperature regions investigated by Lorenz cannot be explained in any way just by formation of aluminate alone, but the formation of calcium silicate must be considered, and inasmuch as the temperature of formation of the first-formed dicalcium silicate is only about 100 degrees C. higher than that of monocalcium aluminate, the author has selected formation of silicate as the second reaction. The author has not followed out very strictly the theory developed by Dyckerhoff, but he has assumed that the available lime—perhaps over that required for dicalcium silicate as intermediate product—first forms monocalcium silicate and that only after the silica has been consumed for this reaction does the lime-rich dicalcium silicate form. This theory is supported by the observation that the burning test samples show many cracks when burnt between the temperatures 1000 and 1,300 degrees C., while this phenomenon is never observed when the burning is carried out below 1,000 degrees C. or above 1,300 degrees C.

Inasmuch as there is scarcely any doubt that the formation of cracks and fissures is due to the high content of dicalcium silicate, it must be concluded that the samples, which are burnt below a temperature of 1,000 degrees C. or about a temperature of 1,300 degrees C., do not contain considerable proportions of dicalcium silicate. As far as the samples burnt below 1,000 degrees C. are concerned, a low dicalcium silicate content can only occur on the assumption that monocalcium silicate is first formed from lime and silica. The fact that in the burning tests carried out by the author on the three different cement mixtures within the temperature range of 950 to 1,000 degrees C., a sudden increase in the dicalcium silicate content took place and that the first signs of the breaking up of the structure of the sample through the formation of cracks were observed at about the same temperatures appears to the writer as an extraordinarily potent support of the theory of reaction assumed by him.

The question now arises what next happens in the union of lime with other ingredients of the raw cement mixture after the silica has been converted by reaction with the lime into dicalcium silicate. The next stages of reaction must consist of the conversion of monocalcium silicate into pentacalcium trialuminate and the formation of calcium ferrite. The author gives precedence to the pentacalcium trialuminate, for the reason that this substance is comparatively easily formed according to Dyckerhoff, while according to Nacken and Gruenewald the formation of calcium ferrite in large quantities is very improbable below its melting point. The yellow color of the sintered product also is evidence of the absence of calcium ferrite.

As the temperature passes through the 1,200 degrees C mark, the clinker passes from the region of light burning to that of sintering. This transition is indicated superficially in change of color of the clinker, in the greater shrinkage of the incandescent mass and in the appearance of an endothermic reaction, which is manifested in the formation of the molten mass. The nature of the chemical reactions that take place between the temperature limits of 1,200 and 1,300 degrees C. has not been known up to the present time. The determination of the free lime leads to the following conclusion which is also based on the other observations explained above.

As soon as a certain amount of calcium ferrite is formed, a eutectic molten mass is formed from it which also contains the previously formed calcium aluminate and calcium silicate. The formation of this molten mass opens the way to the formation of the true clinker minerals, that is alite and celite amongst others. These are apparently formed from the aluminates and the silicates, which have previously been formed in the solid

(*Continued on Page* 50)

Slate Flooring Is Laid with Sawed Tiles of Standard Dimensions

By F. A. WESTBROOK

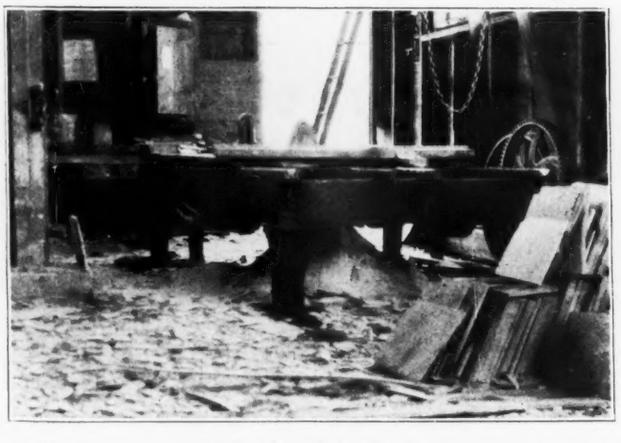
THE Vermont Slate Flooring Corporation has a plant at Poultney, Vt. As its name implies, this company manufactures slate flooring exclusively, buying its raw material from any of the multitude of quarries in the district, according to the color desired.

The distinctive feature of this organization is that it has determined on twenty-one standard sizes of slab and makes nothing else. A typical floor plan, of large size, using all of these sizes in a variegated design which looks as if there were hundreds of different sizes, has been developed; and when an order comes in for a floor of any given size it is simply laid out to scale on the standard sheet. As each size of slab or tile has a distinguishing number, it is a simple matter to count up the quantity of each size required and to take them from stock. Along two edges, of course, some special sizes will be required, but these are reduced to a minimum.

To facilitate the work of the setters on any given job, a blue print is taken from the standard worksheet and sent with the order, each piece of slate being numbered to correspond with the numbers on the print. The floor can be laid out on any part of the sheet so as to give the best appearance and least number of special sizes along the edges.

The mill represents the most modern practice. Raw material may be brought in at either end. In the center is a Patch gang-saw and over this, covering the length of the building, is a 3-ton traveling crane which is operated from the ground. Quarry pieces of slate are moved on to the saw on small cars. There are two of these, so that while one load is being cut up, the other car may be loaded and no time lost with the saw.

Of course the advantage of sawing is that accurate dimensions and good even edges easy to cement well can be obtained. So far as the edges are concerned rubbing is eliminated.

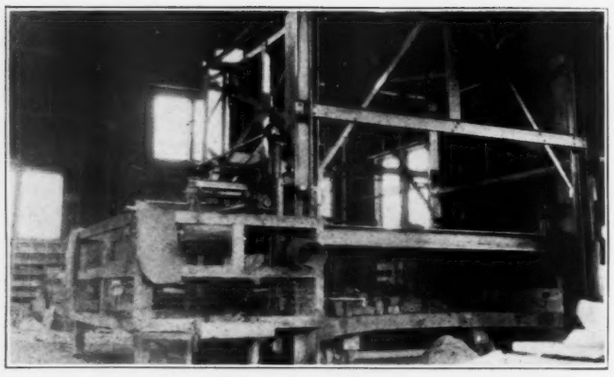


Circular slate saw

Part of slate rubbing bed, and individual hoist

The mill is equipped also with a circular saw for small orders in which the gang-saw cannot be used to advantage, although, of course, with the latter, several sizes can be cut at once and the thickness of the piece does not matter. The required thickness, usually ½ in. or 1 in., can be secured by splitting after sawing.

In addition to the saws, there is a planer and a rubbing bed for orders calling for particularly smooth finish. All of these machines are served by the traveling crane. The rubbing bed is provided with its own individual electrical hoist. Each machine has its individual motor drive. Electrical



Gang-saw, traveling crane in background

equipment is used throughout. This plant was completely equipped by Gray Foundry, Inc., jobbers in mill and quarry machinery.

From this it will be seen that the plant has the most modern labor-saving machinery and is organized along up-to-date lines.

Progressive Heating Raw Cement

(*Continued from Page* 48)

phase, with the simultaneous absorption of lime, at first rapid and then more slowly.

If this is the general scheme for the course of the reaction above a temperature of 1,200 degrees C., then the question remains to be answered: What is the structure of the silicates, aluminates and ferrites which are formed from primary substances during the absorption of lime and which finally form the clinker, that is the alite and celite which are the main constituents of the clinker

It is very probable that monocalcium ferrite is formed as the first ferrite. Inasmuch as the melting point of this compound lies between 1,200 and 1,230 degrees C., the existence of the liquid phase between 1,200 and 1,300 degrees C. explains its formation. The author has not stopped to consider monocalcium ferrite in his study, for the reason that it is very quickly converted into dicalcium ferrite. Moreover, there is always the possibility that dicalcium ferrite does not exist as such but in the form of a double compound, $4CaO.Al_2O_3.Fe_2O_3$, with the hypothetical dicalcium aluminate. The double compound forms a series of mixtures with dicalcium ferrite and the author recognizes it to be alite.

The practically complete agreement between the optical properties of alite with those of tricalcium silicate and jaeneckite appears to the author to confirm in no uncertain manner the conclusion which was reached on purely chemical reasoning, that alite is a series of mixtures of tricalcium silicate and jaeneckite. The author also subscribes to the opinion that the entirely different optically behaving dicalcium silicate cannot be considered as a factor in the formation of alite, entirely aside from the fact that the lime content of normal and lime-rich portland cements is provided for in no manner whatsoever in a dicalcium-alite.

(The original article contains additional discussions of the work of Dyckerhoff regarding the constitution and formation of alite. The interested reader is referred to the original as space is wanting for publication of the complete article here.—Trans.)

The conclusions that can be drawn from this study and research are as follows:

1. Almost half of the lime enters into reaction with the ingredients of the cement rock during the heating of the raw cement mixture to form new compounds, when the residual carbonic acid is driven out of the mixture.

2. The formation of the clinker minerals takes place in order from the lime-poor compounds to the compounds richest in lime.

3. The formation of dicalcium silicate takes place for the most part within the temperature range of 1,000 to 1,250 degrees C.

4. The existence of a sintering melt at the temperature of 1,250 degrees C. causes quite a vigorous combination of lime, during which period the intermediate products, calcium silicate and calcium aluminate, are converted into clinker minerals which are predominantly alite and celite.

5. The quantities of lime, which are combined with the ingredients of the cement rock between approximately 1,250 and 1,450 degrees C., are greater than can be accounted for if it were true that dicalcium silicate forms the main ingredient of the portland cement and clinker.

6. The progress of lime absorption agrees in every way with the assumption that alite must be considered as a series of mixtures of tricalcium silicate and jaeneckite, or—from a mathematical basis—as a series of mixtures of tricalcium silicate and dicalcium aluminate.

Library of Congress Desires Issues of "Cement Mill and Quarry"

We have been requested by the Librarian of Congress to invite our readers to aid him in completing his file of *Cement Mill and Quarry.* The issues that are needed are July 5, 1927; January 5 and 20, 1928; and March 20, 1928.

These numbers are out of print. If any reader can spare any of them, let him communicate directly with H. S. Parsons, Chief Periodical Division Librarian of Congress, Washington, D. C.

Effect of a Bonus on the Accident Record of the Southwestern Portland Cement Co.

By EMORY SMITH

First Aid Miner, U. S. Bureau of Mines, Mine Safety Station, Berkeley, Cal.

THE Victorville cement plant of the Southwestern Portland Cement Co. is located about 1 mile from the city of Victorville, Cal. Two transcontinental railway systems, the Atchison, Topeka & Santa Fe, and the Southern Pacific Railroad, afford shipped facilities. As described in the May 8, 1929 issue of PIT AND QUARRY the plant is modern and well kept, and the officials, especially the higher operating officials, take pride in the appearance of the place. Dust has been practically eliminated by the installation of dust collectors and wet grinding. The plant has a rated capacity of 6,000 barrels of cement daily.

The quarries are located on the Mojave Desert about 7 miles from Victorville and are reached by the Mojave Northern Railroad. The cement plant, quarries, and railroad are all owned and operated by the same company, which employs from 270 to 300 men in all operations. The plant has been in service since 1916. Machinery and equipment are modern, well guarded, and maintained in good condition. Electric power, purchased from the Southern Sierras Power Company, is used throughout the plant.

This company has long been interested in safety and, for several years, has been trying to reduce the number of lost-time accidents. According to available records, the first safety committee was organized in 1921, and the first committee meeting was held on September 15 of that year. The original committee was composed exclusively of foremen and other company officials, and this policy of membership was followed for some years.

This safety committee, composed exclusively of company officials, had the advantage of being practically an executive body with the necessary authority to act without delay or interference but suffered the disadvantage of viewing the accident prevention work entirely from the executive angle. Moreover, when the safety committee is composed of officials only, it is likely to give rise to the attitude among the workingmen that safety is a matter of concern to officials only.

The disadvantages of the system so far outweighed the advantages that in March, 1928, it was superseded by the present method of selecting the members of the safety committee from among the workingmen about the plant. One man, with the consent of his foreman, is now chosen from each of the 16 departments of the plant and serves for six months on the safety committee without extra pay. In order always to have experienced men at the meetings, the periods of service are so arranged that half of the committee changes membership every three months. While foremen and other officials may attend safety meetings and make suggestions, they are not allowed to serve on the safety committee. Meetings are held on the last Friday of each month and the minutes are sent to the superintendent's office for consideration at the regular foreman's meeting on the following morning.

One man is selected from the safety committee to act as a safety inspector about the plant. Each department is represented by one member of the committee, and each member is supposed to pay particular attention to his own department, with which he is familiar, and immediately correct or report to his foreman any condition or practice which he may regard as unsafe.

Records of the original safety committee meeting of September 15, 1921, and all subsequent monthly meetings have been typed and filed in a loose-leaf ledger; this complete set of minutes is open for inspection of every employee of the company. Examination of this interesting record of activities shows to what extent the company supported the committee. To April, 1929, the record shows that 128 recommendations were submitted by the committee and, of these, 122 were carried out in all respects, 5 were partially completed, and only 1 rejected. These recommendations covered practically everything under safety and welfare, from broken rails in the yard track to broken dishes in the boarding house.

In spite of all efforts, however, the accident record did not react in the manner in which the company officials believed it should, and it was decided to supplement other activities with a bonus system. In order to make a fair system, the men were arranged in ten "teams," so grouped as to equalize the hazard as far as possible. From 25 to 30 men compose a team and the member of any team completing a month without lost time due to an industrial accident are given a bonus of 1 per cent of their monthly pay. In case an accident occurs, however, the team of which the victim is a member does not receive a bonus for any month during which the accident causes a loss of time.

The result of the bonus system was both surprising and gratifying from the start. Since it was inaugurated in May, 1928, only two teams have

* Reprinted from U. S. Bureau of Mines Information Circular No. 6176.

failed to receive a bonus for every month, and for 12 consecutive months there has not been a lost-time accident and no time has been lost due to previous accidents. Following is a list of months showing the number of hours lost per 1,000 man-hours worked since January, 1925.

Hours of lost time per 1,000 *man-hours worked since January,* 1925

January	4.075	1.767	2.745	None	None
February	3.927	6.298	4.940	0.129	do.
March	4.713	4.102	6.950	3.409	do.
April	4.706	5.581	12.047	4.109	do.
May	4.457	3.490	5.650	*4.132	do.
June	3.437	3.498	4.880	3.480	do.
July	9.623	7.899	0.139	2.254	do.
August	6.490	4.343	2.730	None	—
September	3.722	3.622	5.690	do.	—
October	7.924	4.651	8.740	do.	—
November	5.448	5.132	2.750	do.	—
December	4.388	11.400	3.094	do.	—

It is quite generally believed by both men and management that the bonus system is responsible for this reduction of accidents as, prior to the introduction of the bonus, there had been only one month free from lost time in 12 years of operation.

Costs of the bonus could not be compared directly to costs of hospitalization, or compensation, but the following excerpt from a letter written by the chairman of the safety committee would indicate that the cost of the bonus system is considerably less than the cost of accidents:

"The average cost of safety is approximately one-third of what increased insurance would be, did we not have our present safety activities, training, education, guards, etc."

Extensive use is made of the bulletin board and interesting pictorial news is shown in addition to the regular safety posters, in order to attact wider and more favorable attention.

At the beginning of the present year a bulletin board was erected to show lost-time accidents, the department suffering the accident, and the month in which the accident occurred. On this board is painted the outline of a flag which is divided into 12 columns, each of the columns containing 16 blocks. The 12 columns correspond to the 12 months of the year, and each of the blocks represents one of the 16 departments of the plant. A cross is outlined at the center of the flag and the whole is painted a neutral color. At the end of each month the monthly column is painted and a color scheme is followed which at the end of the year will have the board painted with a green field and a white cross of the "no-accident" flag of the Portland Cement Association. However, should a lost-time accident occur, the block representing the department in which it occurred will be painted red for each month during which there is lost time.

That those in charge of this plant are making effective their efforts and methods toward prevention of accidents is very well shown in the foregoing tabulation which indicates that starting with August, 1928, this entire plant, employing upwards of 250 men, did not have a lost-time accident up to and including July, 1929—a full 12 month period.

While the month-by-month record as to hours of lost time by accidents per 1,000 man-hours worked, shown in the tabulation, indicates that for the years 1925, 1926, 1927, and the first half of 1928, the record was uniformly good, nevertheless the ultimate goal of no lost-time accidents was not reached until August, 1928.

An inspection of the table almost forces the conclusion that the institution of the bonus system in May, 1928, was the final refinement in the accident prevention practices of this plant which "put over" the no-lost-time accident program; 4.132 hours lost per 1,000 man-hours worked in May, 1928, the month of the institution of the bonus system, was not far from the general month-by-month average of the three previous years; yet on the second month the bonus was in effect, the number of hours lost by accident per 1,000 man-hours worked dropped to 3.480, in the next month it dropped to 2.254, and in every succeeding month (from July, 1928 to August, 1929) the plant worked without lost-time accidents.

Possibly with the bonus system, credit should also be given the change from the all-official safety committee system to the all-employee safety committee system made effective in March, 1928. In any event the excellent record of 12 months without a lost-time accident, in a plant involving the utilization of the services of 270 to 300 men, could be accomplished only through the combined effort not only of the safety committees and of each and every one of the individual workers of the plant, but also of the intelligent, sympathetic cooperation and direct supervision of the employers' representatives.

* Bonus system started May, 1928.

Aviation Aids Business Man

Following the recent meeting of The Waukesha Motor Company at which unanimous approval was given to the directors' plan for increasing the capital to 500,000 non-par shares, President H. L. Horning found it necessary to conserve his time and to keep many of his appointments by airplane. On the morning of October 17 he chartered a steam-heated cabin monoplane of the Kohler Aviation Company and left at daybreak from Maitland Field, Milwaukee, to keep a ten o'clock appointment in Detroit.

Arizona Produces Onyx

In a paper presented recently before the Yavapai County Chamber of Commerce at Prescott, Ariz., Mayer G. Hansen stated that there is a deposit of beautiful onyx near the town of Mayer which has been operated periodically for forty years. There are about ten quarries that operate at present.

This stone sells for $15 to $20 per cubic foot, and the quarrying cost is around $5 per cubic foot.

Leonard Gravel Company at Lansing, Michigan Has Unusual Method of Stockpiling

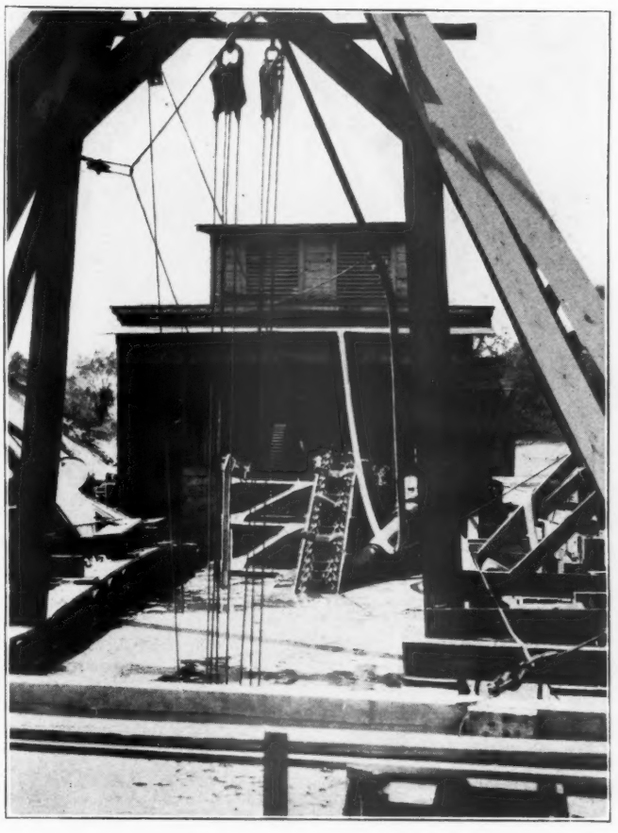
Conveyor System Gives Sufficient Storage Capacity To Carry Over Unproductive Winter Months

THE Leonard Gravel Company of Lansing, Michigan, conducts one of the most interesting operations in a section abounding in sand and gravel plants. The present pit has been operated for fifteen years and was taken over five years ago by F. P. Leonard, vice-president and general manager of the company. He ran the old plant as an independent operator until three years ago when the present company was organized, consolidating four plants all in the vicinity of Lansing and taking over all machinery, leases and other property. The property consists of 360 acres of gravel deposits of which 200 acres have access to railroads for shipment. Two years ago the present plant was built.

The Main Plant

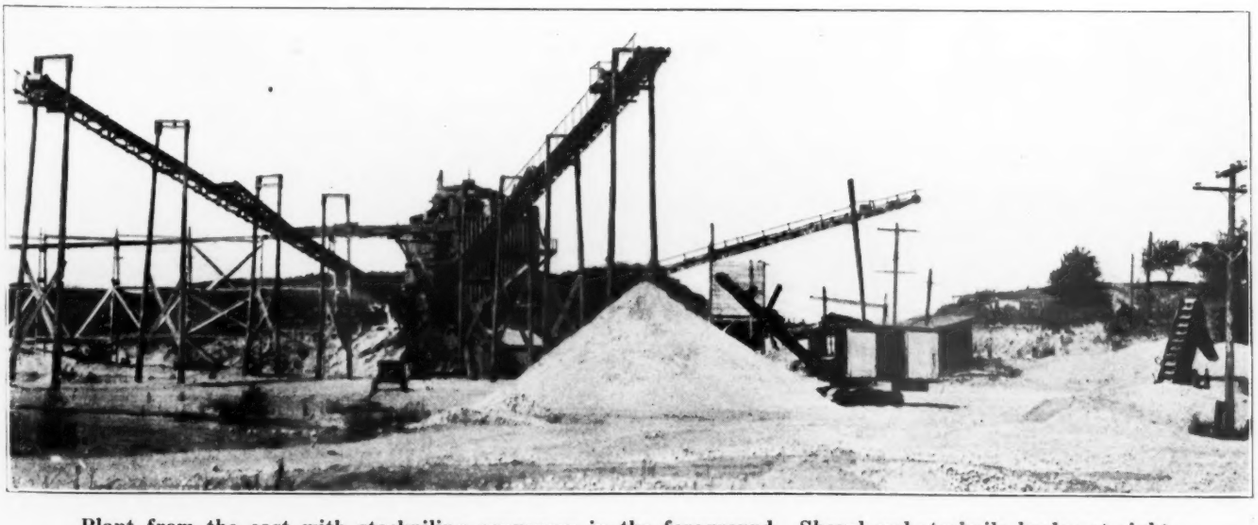
The deposit being worked is on a hogback of gravel which runs almost across the entire state. The 80 acres at this location runs about 50 per cent gravel and the same percentage of sand. The deposit is 50 feet high above the water level and runs about 30 feet below the water.

The dredge which excavates the sand and gravel is of wooden construction with an A-frame supported on steel barrel pontoons. A 45-ft. Swintek ladder which was installed this year feeds the gravel to the intake nozzle. The 10-in. dredge pump is a Hetherington and Berner and is direct driven by a 20-hp. General Electric motor. The ladder is driven through a Hewitt belt by a 20-hp. motor. A Lidgerwood 3-drum hoist driven by a 20-hp. motor operates the ladder and two shore lines. A jet of water from a pipe on the dredge A-frame washes down the bank into the pit.

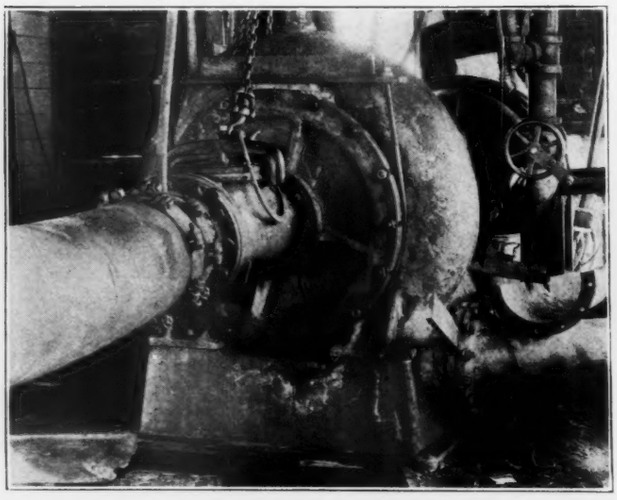


Closeup of front end of dredge. Note size of stone being brought up by ladder

The pipe line discharges at the plant into a steel-lined wooden chute feeding the 3-deck Simplicity



Plant from the east with stockpiling conveyors in the foreground. Shovel and stockpile loader at right



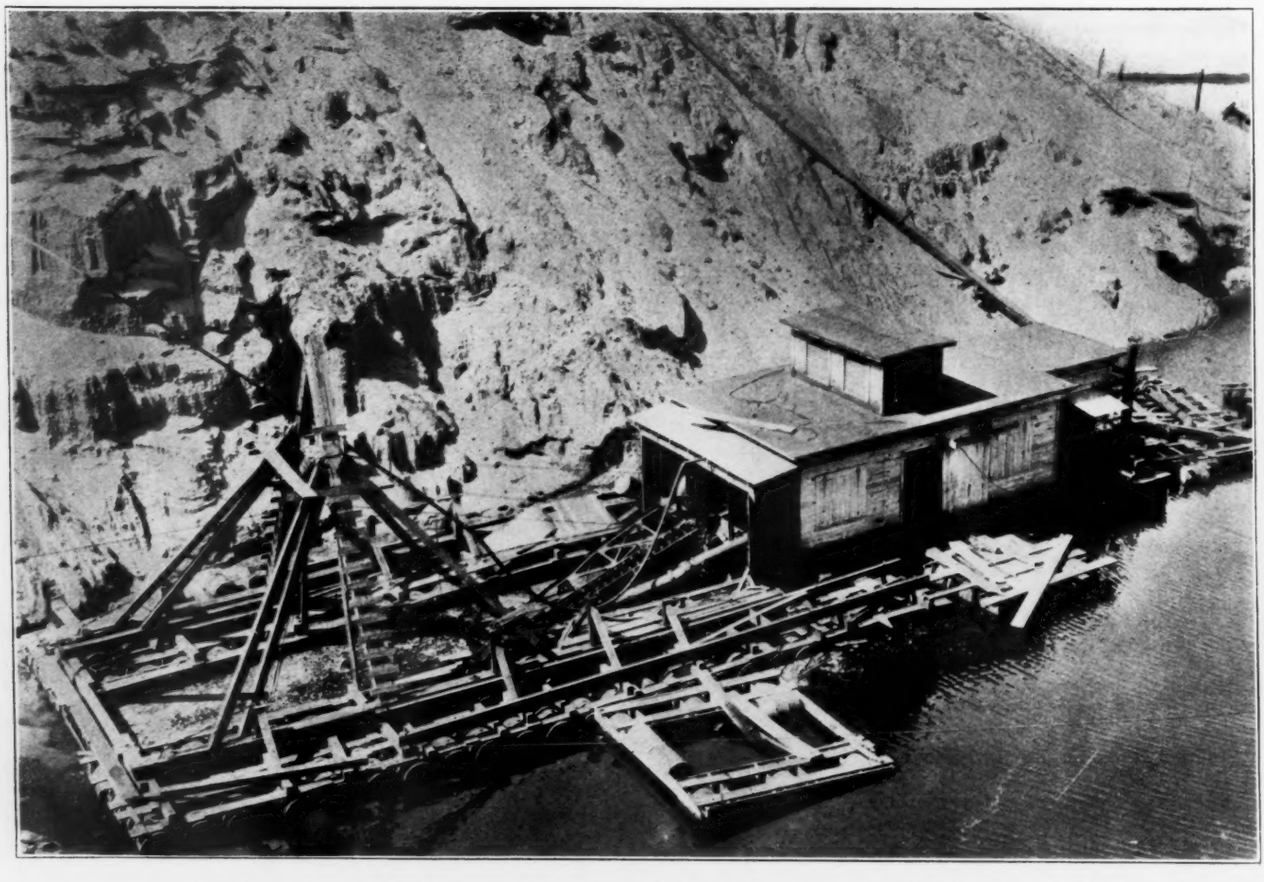
The 10-in. dredge pump with 250-hp. motor in background

Stockpiler loading into truck. F. P. Leonard, vice-pres. and gen. mgr. operating loader

gyrating screen which does all of the sizing. It has 1½-in. cloth on the top deck, ⅜-in. on the second deck and ⅛-in. and ¼-in. on the bottom, giving two sizes of gravel and two of sand. The oversize from the top deck goes to an 8-in. by 36-in. Universal jaw crusher which is belt driven by a 50-hp. motor. The crushed stone is taken by a Link-Belt chain bucket elevator to the top of the plant and re-screened.

The ⅜-in. to 1½-in. stone goes through a steel chute with 1-in. perforations in the bottom, the two resulting sizes each going to separate bins. The ¼-in. to ⅜-in. gravel is chuted directly to another bin. The two sizes of sand go to two 8-ft. by 16-ft. by 4-ft. deep sand wash boxes of own design which discharged into the bins. Waste water is flumed to an abandoned section of the pit. The five wooden bins have a total capacity of 100 cu. yd.

Three stockpiling conveyors radiating from the plant are used for storing the various sizes. These are supported on wooden framework and are each

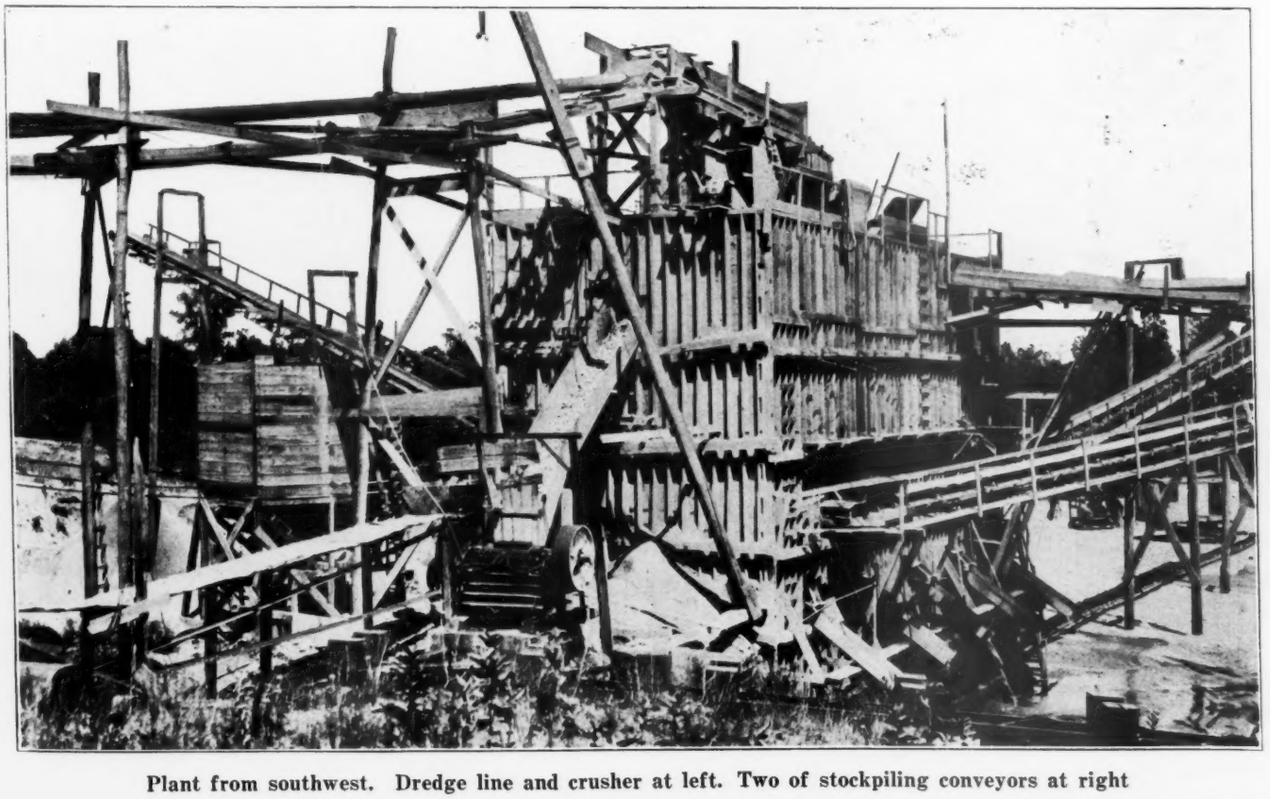


Looking down on dredge from top of east bank of pit. Jet at left breaks down bank

Triple-deck gyrating screen which does all of sizing at main plant

Loading truck from bins. Conveyor for mixed aggregate at left

24 in. wide. One of these, 200 ft. long, is fed by chutes from the large and medium size gravel bins and has a tripper about 100 ft. from the end so that the two sizes can be stored in individual piles. Another conveyor of the same length similarly stores the two sizes of sand. A third con-



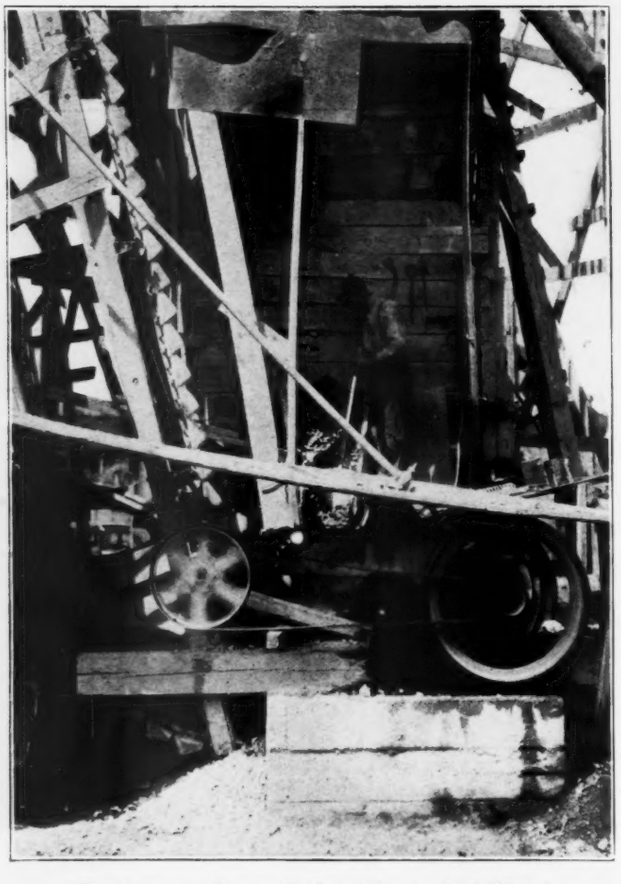
Plant from southwest. Dredge line and crusher at left. Two of stockpiling conveyors at right

Shovel loading from stockpile to truck, plant in background

veyor for mixed aggregate will take coarse sand and either fine or medium gravel. It discharges at its end into a stockpile. A tripper allows discharging into a 100-yd. capacity wooden bin from which the mixed aggregate is loaded into trucks. Each of the conveyors is driven at the discharge end by a 7½-hp. motor.

The other sizes are loaded from the bins directly into trucks. Movement of the trucks is facilitated by concrete runways about the plant and under the gates. The stockpiled material is recovered by a Haiss electric path-digging stockpile loader and an Austin ⅞-yd. gasoline shovel. All deliveries are made in trucks for local work. The capacity of the plant is 500 cu. yd. per day.

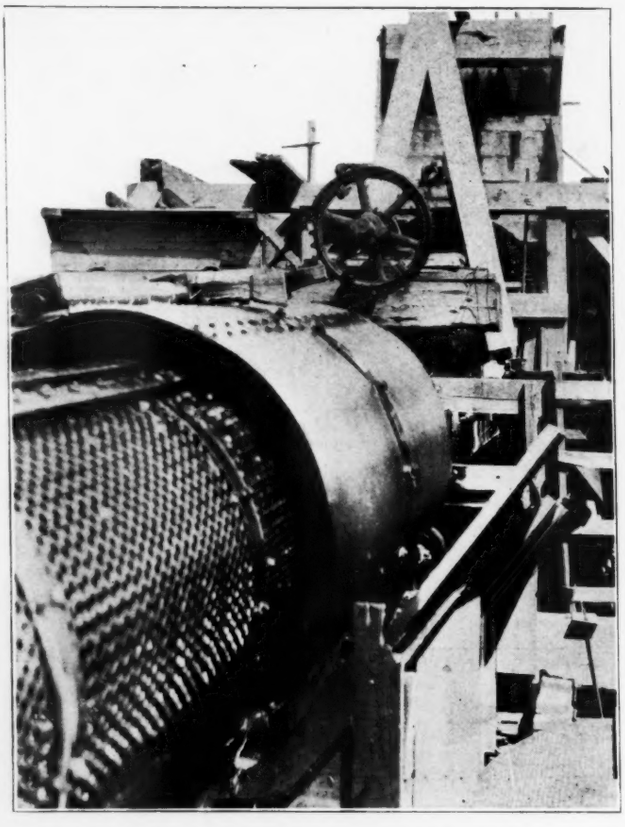
Additional wash water is furnished by a Novo 4-in. centrifugal pump in the pit, the pipe line running parallel with the dredge line. The conveyors all have Hewitt gutta percha belting and Russel rollers. All drive belts are Hewitt "Sagamore" and Republic suction hose is used on the dredge.



The jaw crusher and elevator at plant No. 4

Plant No. 4

The second largest plant taken over by the company is also being operated and is known as Plant

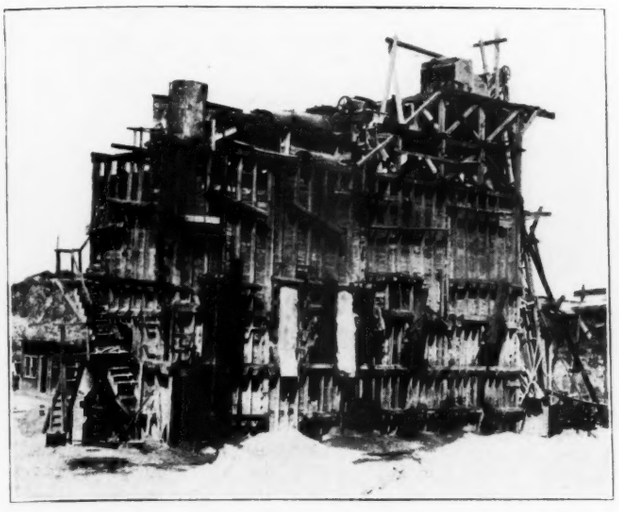


The revolving sizing screen at plant No. 4

No. 4. This is located on the same hog-back as the main plant, but is two miles further south. The 160-acre property is served by a railroad siding but all shipments are now being made by truck. The present plant has been in operation for seven years and has a capacity of 250 cu. yd. per day.

The dredge has an 8-in. Amsco pump and a pipe nozzle without an agitator. The pump is direct driven by a 150-hp. General Electric motor. An American Hoist and Derrick Company 3-drum hoist handles the boom and the two shore lines. A jet of water washes down the bank.

The pipe line discharges into a wooden chute which feeds a single Stephens-Adamson conical scalping screen with 1½-in. perforations. The oversize is chuted to a bin feeding a Reliance 9-in. by 13-in. jaw crusher. The crushed stone goes



Plant No. 4 from southeast with dredge line at right and office at left

to a Universal belt bucket elevator which discharges back into the pumping box. Both crusher and elevator are driven from the same 25-h.p. motor. The material passing through the scalping screen goes to a 42-in. by 19-ft. Good Roads revolving screen with a sand jacket. This produces three sizes of gravel and sand, the latter going to two Telsmith sand settling tanks. The four wooden bins have a total capacity of 450 cu. yd., one of them being divided and used for pea gravel and 1-in. gravel. An Orton and Steinbrenner locomotive crane with a 1½-yd. clamshell bucket does any rehandling of material.

Miscellaneous

A third plant nearby is used for road gravel only. Two Novo draglines with 1-yd. buckets feed from the pit to a revolving screen, from which the material goes directly into trucks. This plant has a capacity of 200 cu. yd. per day.

Officers of the company are H. D. Luce, president; F. P. Leonard, vice-president and general manager; and Malcolm Sheltraw, secretary and treasurer.

Uses of Fuller's Earth

Fuller's earth is used mainly as a filtering medium in clarifying or bleaching fats, greases, and mineral and vegetable oils, says the United States Bureau of Mines. Its original use was in fulling woolen cloth, and from that it derived its name, but such use, at least in this country, has almost been abandoned. Fuller's earth is also said to be used in the manufacture of pigments for printing wall paper, in detecting certain coloring matters in some food products, as a substitute for talcum powder, and in medicine as a poultice and as an antidote for alkaloid poisons. Another suggested use is in deliming hides in the manufacture of leather. It has been stated that the fuller's earth cake from oil mills can be used in the manufacture of hand soaps, concrete waterproofing, and asphalt preparations.

To within the past few years the term fuller's earth has been applied only to claylike materials that possess the property of bleaching, clarifying, decolorizing, or filtering mineral and vegetable oils and animal fats and greases. Material discovered recently in the far West, which is of a different character, is said to be of excellent quality for filtering or clarifying oils.

Fuller's earth was first discovered in the United States in 1891 near Alexander, Ark., by John Olsen. The mineral was used for a time by the Southern Cotton Oil Co., at Little Rock, Arkansas, but its use was finally abandoned. The real beginning of the industry in this country, however, was in 1893, near Quincy, Florida, when quite by accident in an unsuccessful effort to burn brick on the property of a cigar company, a employee called attention to the close resemblance between the clay used and the German fuller's earth. This discovery in Florida caused considerable excitement, and deposits of fuller's earth were reported from a number of states, but the material in most of these deposits was found to have no value as fuller's earth. Production began in Florida almost immediately after the discovery and, from 1897 to 1899, fuller's earth was produced in Florida, Colorado, New York and Utah. Florida maintained its rank as the leading producer continuously until 1924. In 1901 Arkansas again became a producer. From 1904 to 1907 Arkansas was the second largest producer, but no production of fuller's earth has been reported from Arkansas since 1922. Fuller's earth was found in Georgia soon after the discovery in Florida, but Georgia did not become a producer until 1907, when it ranked third as a producing state; it ranked second from 1909 to 1923, except in 1918 and 1919 when Texas was second; and since 1924 it has ranked first. In 1904 Alabama and Massachusetts, in 1907 South Carolina and Texas, in 1909 California, in 1918 Nevada, and in 1922 Illinois and Pennsylvania first appeared as producers. In 1928 Colorado reappeared as a producer of fuller's earth. Pennsylvania has reported no production since 1922.

Further details are given in the statistical report entitled "Fuller's Earth in 1928," by Jefferson Middleton, which has been recently published by the United States Bureau of Mines, Department of Commerce. The paper is obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., at a price of 5 cents.

Concrete Mixing Plant Erected for Use During Erection of Power House

By F. A. WESTBROOK

THE New York Edison Company has constructed a new power house at the foot of 14th Street and the East River, this being one of the largest power houses in the country. As is usual with this progressive company in all branches of its activities the most up-to-date methods of economical operation were embodied so that it is only consistent that its central concrete-mixing plant should be effective and interesting.

The elevators and conveyors for this were furnished by the George Haiss Manufacturing Company of New York City, and that they furnished satisfactory service is proved by the fact that the machinery ran night and day for over a year and stood up in excellent shape with very little wear showing on the sprockets and chains in all that time. The capacity of each elevator was designed for 130 cu. yd. per hr.

There were two main elevators. These were of the double-strand continuous type, 48 in. between centers, with chains of manganese steel, sprockets of high-carbon steel, and cut-steel gears. The chains are of the roller-thimble type. One elevator at a time was used, the other being kept spare for emergency service and to facilitate maintenance.

At the head of these elevators there were swivel spouts to discharge the materials from the elevators onto a central belt conveyor which carried it to the different bins. This conveyor was 30 in. wide, 230 ft. between centers, with five Haiss pulley driving carriers. There were twenty-five 30-in. belt carriers, a 24-in. diameter head pulley, and a 20-in. foot pulley. Steel-cut gears and counter shafting were used.

Slat conveyor in cement shed

Under the bins there are, in all, twenty-four Haiss 14-in. by 18-in. steel bin-gates.

In addition to this equipment a Haiss slat conveyor was installed in the cement shed for carrying cement bags. This was an 18-in. conveyor, 85 ft. between centers, with chains and pins and a complete set of head and tail sprockets, pinions and gears, together with a cut-steel motor pinion.

Main elevator

Swivel spouts at head of elevator

Many Important Improvements Mark the Coming Edition of Pit and Quarry Handbook

Complete Revision, a Trade Directory, and New Format Place It Far Above Its Predecessors

THE eighth annual edition of PIT AND QUARRY HANDBOOK, which is fast nearing completion, will represent a significant advance over all previous editions of that work and will set new high standards in the field of reference-book publishing. The many thousands of readers, who have found earlier editions so useful in helping them to a better understanding of the many problems that confront them, will find in the 1930 edition a work that completely overshadows—in comprehensiveness, accuracy, method of presentation, and convenience of arrangement—anything they have heretofore seen. To those to whom the HANDBOOK is as yet unknown it will present a collection of features and qualities which, while essential to the making of a complete reference work, are seldom found in a single book.

The HANDBOOK has been designed to provide the producer and manufacturer of non-metallic minerals and their products with useful, up-to-date, and dependable information on the practical problems of operation and management. From an investigation of the minerals which form the basis of the pit and quarry industries—their varieties, characteristics, distribution, and the like—to a discussion of the most approved practices—such as fire and accident prevention, cost accounting, traffic management, etc.—followed in the management of modern producing plants, no important subject has been omitted and no important phase of any such subject has been neglected. On every question that may be expected to arise in everyday plant operation, the HANDBOOK gives either an answer or some helpful suggestion for finding one. In short, the work is so broad in scope, yet so detailed in many of its discussions, that nothing short of a systematic study of its contents can give an adequate idea of the thoughtfulness with which it has been conceived, the care with which it has been planned and produced, or of the success with which the ends for which it was designed have been attained.

Written and edited by men who have devoted many years to the study and solution of operating problems, it is inevitable that the HANDBOOK should approach every question from the operator's standpoint, that it should emphasize the practical rather than the theoretical. Yet the engineer, the highly-trained technical man, will find the work filled with technical material, engineering data and technological discussions, selected and presented with a view to their practical application to everyday problems. And the non-technical man will find the theory of his problems and processes stated in terms which he can readily understand and safely apply.

Directory Forms Are Closing

Non-metallic mineral producers who have not yet sent in information regarding their companies and plants for the Directory Section of PIT AND QUARRY HANDBOOK, are urged to do so at once.

The new (23d) edition of the *Directory of Cement, Gypsum, Lime, Sand, Gravel, and Crushed-Stone Plants* is now nearly ready for publication and, unless producers send in promptly the information they have been asked to furnish, their companies cannot be listed in the forthcoming book.

Producers who are not listed in the new *Directory* certainly cannot hope to derive any advantage from being left out, while those who are listed therein may be expected to reap all the benefits of inclusion in the industry's standard trade directory. Material buyers cannot be blamed if they fail to patronize producers who neglect to have their companies listed in the trade's oldest buyers' guide.

Questionnaires not yet filled in and in the mails should be taken care of promptly and forwarded at once to The Editor, PIT AND QUARRY HANDBOOK AND DIRECTORY, 538 S. Clark St., Chicago. Additional forms, if needed, will be sent promptly on receipt of requests.

Arrangement of Contents

As far as possible a logical sequence of idea has been followed in the arrangement of the information presented. Starting with a discussion of the geology and geography of non-metallic minerals, the work carries the reader progressively upward and forward, through the problems of prospecting, plant design and the various methods of recovering the raw material, treating it, storing it, and preparing it for shipment. Paralleling the discussion of processes, goes a discussion of the equipment available for performing them, of its proper application and use, and of the alternative forms of power that can be effectively employed. Then follows a discussion of the best modern practices in the handling of accident, fire, insurance, cost, and traffic problems, all viewed from the standpoint of the executive who is expected to face and solve them.

These qualities have characterized the HANDBOOK for years, and the new edition not only preserves these excellencies but adds to them the betterments suggested each year through a wider use

of the work and a more sympathetic understanding of the reader's needs.

Most noticeable of the many improvements incorporated in the 1930 edition of the HANDBOOK will be the format in which it will appear. The old page size of 6 by 9 in. has been discarded for that of PIT AND QUARRY'S pages. The new size—9 by 12 in.—besides doubling the space available, permits the use of larger and more readable type and larger and clearer illustrations. Text matter and illustrations will be printed on high-grade enameled paper, the same as is used in PIT AND QUARRY, and the superior printing surface thus provided will enhance still further the readability and appearance of the pages. For the flexible binding used on former editions, there will be substituted stiff boards covered by a beautiful and durable vellum—a form of binding that will harmonize perfectly, in quality and appearance, with the book's contents.

Section Indexes

A new feature that will commend itself immediately to all classes of readers is the topical index which will precede each section. Heretofore, the reader seeking information on some division of the subject indicated by a section title has been forced to search through the text matter, guided solely by cross-heads, which, on account of their nature and scarcity, could not be expected to give an adequate key to the contents. Under the new plan a complete index to text matter, tabular data, and illustrations will direct the reader instantly to the very paragraphs containing the information sought. This departure marks a great step forward in the publisher's aim to make the HANDBOOK'S contents as useful and accessible as possible.

In every respect the new edition may be said to be a new work. Of its thirty-five sections on technical and non-technical subjects, seven provide material which has not appeared in any previous edition. A. J. Hoskin, PIT AND QUARRY'S editor, has contributed one on *The Geology and Geography of Non-metallic Minerals* and another on *The Excavation of Underground Deposits.* The former will be illustrated by a series of fifteen specially-prepared maps, showing the geographical distribution of thirty minerals of frequent occurrence and indicating where these are found in quantities not warranting commercial exploitation. *Central Plants for the Preparation and Delivery of Concrete and Mortar,* a subject of ever-growing importance, has been treated by J. O. Durkee, assistant editor of PIT AND QUARRY, and *Prospecting and Evaluating Pit and Quarry Lands,* an essential preliminary to successful exploitation, has been discussed by G. B. Massey, associate editor. *Electrical Equipment* will form the subject of a section by E. W. Pilgrim, an electrical engineer who has made a thorough study of the electric-power problems of non-metallic minerals producers. E. H. McEuen, a lime engineer of broad experience, has written on *By-Product Possibilities in Lime Manufacture.*

Ten of the remaining twenty-nine sections devoted to technical and management problems have been entirely rewritten. These include the sections on *Plant Design; Hydraulicking and Dredging; The Dry Removal of Loose Overburden; Loading and Intra-plant Transportation; Screening; Washing; Burning; Slurry Pumping and Filtration; Self-Unloading Boats;* and *Statistics.* Eighteen other sections—*Drilling and Blasting; Pumping; Crushing; Elevating and Conveying; Drying; Open Storage, Reclamation, and Bin Storage; Waste-Heat Recovery; Dust Collection; Power-plant Operation; Power Transmission; Internal-Combustion Engines; The Hydration of Lime; Packing and Loading for Shipment; Lubrication; Fire Prevention; Accident Prevention; Insurance;* and *Cost Accounting*—have been thoroughly revised to include discussion of the latest refinements in equipment design and operating and management practice.

A Complete Trade Directory

A *Directory of Cement, Gypsum, Lime, Sand, Gravel and Crushed-Stone Plants* will form one of the outstanding features of the new HANDBOOK. Having passed through twenty-two editions as an independent publication, it will appear in this, its twenty-third edition, as a part of PIT AND QUARRY HANDBOOK. It will show the same evidences of careful planning, both in the nature of the material offered and in the scheme of arrangement, as will be observed in every other section of the HANDBOOK, and will exhibit the same advance beyond its predecessors as the new edition of the HANDBOOK shows when compared with earlier editions.

The *Directory* section represents an entirely new work. A new plan of investigation has been followed, a new scheme of classification has been worked out, and a different arrangement of the published material developed. An alphabetical division will list all producing companies in alphabetical order by name, while a geographical division, arranged alphabetically by states and cities, will list all producing plants. The first division, which will give information regarding company headquarters (executives' names, number and location of plants, etc.), will lead the reader directly to the information he desires when only the company name is known to him. The second division, which will give information regarding each company's plants (products, capacities, methods,

(*Continued on page* 82)

Methods of Crushing, Washing and Grinding Barite in France*

By ROBERT D. LANCE

NATURAL barium sulphate or barite, $BaSO_4$, known also as barite or heavy spar, is found in liberal deposits in most of the southeastern quarter of France, and is mined and processed for a large variety of uses, such as painting, manufacture of colors, paper fillers and glazes, textile manufacture, and chemical and metallurgical industries.

Barite is found in agglomerated masses of crystalline elements of varying form, sometimes tabular and sometimes in elongated crystals, but all belonging to the orthorhombic system. Its specific gravity lies between 4.3 and 4.7. It is insensible to acids, and is almost insoluble in water, one part of barium sulphate requiring 200,000 parts of water for solution. It is more soluble in warm hydrochloric acid (one part in 4,800) but as the acid cools the sulphate is rapidly precipitated in the form of a very fine powder.

The mineral is found in France either alone or associated with galena, and in greater or less purity, according to the deposits. The more common impurities are calcium sulphate, clay, and sometimes also iron oxide and free silica. The amount of these impurities varies from deposit to deposit, and even in different depths of the same vein, and the uses for which the barite can be sold depend on the particular impurities contained. For instance, barite which is considered bad for reduction operations because of a high percentage of silica and lime is good for filler; another barite, however, may be unsuitable for filler because it is colored with iron oxide, and yet be excellent for reduction because it is free from silica and calcium sulphate.

As the barite is found in veins it is recovered, except for surface outcrop deposits, in galleries, thus being more in the nature of mining than of quarrying. A preliminary sorting is done in the mine to separate the barites as much as possible from the encasing rocks that may have been broken down with it, and the mineral is loaded, generally by hand, into cars which are then drawn out of the mine. Depending on the size of the operation, the hauling is done by hand labor, by animals or by mechanical power.

The processes that the mineral undergoes from the time it leaves the mine are very diverse, corresponding to the different uses for which it is sold. Some industries (certain chemical operations) buy the run-of-mine barite, either because it can be used in its native state or because they make their own preparatory treatments for their own work. More often, however, the barite is refined by washing and grinding before being sold. In this case it is carried from the mine, by horse-drawn carts, motor trucks, industrial railways or aerial tramways, to the processing plant. The mineral arriving at the plant is generally given a second hand sorting, preferably on a moving belt, and usually after a preliminary crushing in a jaw crusher. After this sorting, the barite in some plants is sent to the grinding mills. In other plants, the picking is followed by a washing process and the mineral is ground after this refining.

Washing

The purpose of the washing is not to carry away the impurities contained in the barium sulphate itself, but rather to remove the earthy materials that may have contaminated it in the course of handling and transporting, as well as the foreign matter originating from the surrounding rocks. This washing is made easier by the fact that the density of the barite is considerably higher than that of the other materials.

For the rock particles, the washing is done in trommels set in wash boxes; in this process, however, some of the fine barite is carried away with the sediment, this loss being all the easier the purer the barite is and the less silica it contains. These fines are advantageously washed in a machine similar to those used for washing sand, consisting essentially of an inclined cylinder of steel plate, actuated by gears or friction rollers. The fines to be washed are introduced into the cylinder at the lower end; water, however, at the upper end. The solid materials move up the cylinder following a long trajectory, during which they are in contact with the water flowing in the opposite direction, which scours from them the earth and clay that they contain. During its upward movement the barite, washed cleaner and cleaner, meets cleaner and cleaner water, and this methodical washing produces at the upper end of the cylinder, where the material is discharged, a barium sulphate completely cleansed of the foreign materials, such as rock of the same fineness but of less specific gravity.

Grinding

Grinding is done either by the wet or by the dry method. In the first case, the barite can be used just as it issues from the washers; in the latter

*Translated and abridged from *Mines, Carrieres, Grandes Enterprises*, Paris, Sept. 1929, pp. 97-107.

case it must be dried. In some plants the barite is calcined before grinding by either method, this calcination being performed in special continuous kilns. The barium sulphate so calcined is much easier to pulverize than the raw mine product, especially if it is siliceous, and there is thus a saving in motive power. This depends on the variety of the mineral, however, for in certain cases the cost of calcining can nullify the economy of grinding, and also some barites containing iron take on a yellowish taint during calcination which considerably lowers their value.

To produce economically materials of good quality and as finely ground as possible, the grinding plant must be equipped with machines judiciously chosen and efficiently grouped. If the barite has been calcined, there is no need of crushing, because the calcination reduces the mineral sizes which the finish mills, whatever they are, can take.

For crushing (on uncalcined barite), if only one machine is used, the jaw crusher is preferable to the gyratory because with a crusher of small capacity the jaw opening is still large enough to take large pieces; a gyratory admitting the barite in the same dimensions could only be a machine of quite large capacity and consequently of greater power than most French operations require. The combination of the two types and a sizing screen placed before them gives a maximum of satisfaction with a minimum of power, because it enables each machine to work to best advantage, the screen eliminating the fines and small sizes which, passing needlessly through the jaw crusher, would diminish its capacity. The pieces thus eliminated feed the gyratory. In this arrangement the gyratory can be replaced advantageously by a ball mill, particularly in small and medium plants. All of the machines mentioned work dry.

The finish grinding can be done by the dry or the wet method. In large plants tube mills (wet or dry), or roller mills provided with air separators (dry method) are used; in moderate or small operations, rotating cylinders of intermittent operation, or grinding stones (wet or dry), or hammer mills (dry method).

The use of air separators, with automatic return of oversize to the mill, makes it possible to obtain the same fineness as with the wet process and at a lower cost. The separation of water from the wet-ground products requires either filter-presses or vacuum filters, then a drying in continuous dryers, generally rotary. This work, longer and more complicated, aside from the fuel used in drying, is consequently more expensive.

The ground products, whatever their method of grinding are either sacked, if they are white enough for use, or further treated by chemical refinement.

Refining

Some barite contains a certain proportion of iron, which alters their white color. Most of this iron can be removed by putting the pulverized barite to digest in vats with or without agitators, with water acidulated with hydrochloric acid or a mixture of hydrochloric and sulphuric acids, if the barite contains no calcium carbonate, then by washing it so as to take away the soluble iron salts and excess acids. With closed rotary cylinders, provided with ceramic or siliceous lining, this refining can be done in conjunction with the grinding. It is thus more rapid and also more complete.

In case lime is found in the carbonate form, the hydrochloric acid, used alone, makes it possible to remove it along with the iron. The removal of silica would be equally possible by treatment when hot or by means of soda liquors.

After acidulation the barite is washed, decanted, then passed to a rotary dryer. After drying it is sacked, the same as that ground dry.

Preparation of Barium Sulphide

For all uses of barite in which it is valued for its physical properties (as in manufacture of papers, colors, etc.) it is ready for the market after the processes just described. Barite also has, however, a considerable importance in chemistry, for it serves in preparing the oxides, the barium compounds, and certain mineral colors used in industry and in the trades. Strictly speaking it is the sulphide of barium, the soluble direct derivate of natural barium sulphate, which is the point of departure for all the reactions which yield the industrial barytic products, used in numerous important manufacturing processes. It is thus the production of barium sulphide which, from the chemical point of view, constitutes the most important of the markets for barite. It is this also which requires the purest barium sulphate.

The conversion of barium sulphate to barium sulphide (BaS) is a simple operation which is accomplished by reducing the barite by means of coal. The production is the greater as the barium sulphate is the more finely pulverized and the less silica and lime it contains. This reduction takes place at a dull red heat and in the most reductive atmosphere possible. The reverberatory furnace is suitable for small operations, but it demands a considerable consumption of fuel and constant supervision to maintain its reducing action. The stirring by hand is also quite laborious.

Consequently instead of the reverberatory furnace there has been substituted, especially in plants of moderate size, kilns with vertical retorts, which are emptied regularly of part of the charge, the empty space above them being filled with a new charge. Although this system dispenses with hand

(*Continued on page 69*)

Internal Check Factors for Organization Personnel

By J. J. BERLINER

THE full application of the principles of internal check is impossible under every situation, since such matters as personnel, local conditions, and so forth, may favor strongly the contrary. But by knowing the usual places at which guards should be placed, it ought not to be a difficult matter to develop ways by means of which system procedures may be formulated so as to curtail markedly the possibilities for fraud and defalcation.

The basic idea is to arrange the detail procedures of a system in such a manner that an internal audit or check of the books is carried out continually by the staff employees—the work of one department or person acting as a check upon the accuracy of the work done in another department or by another person. Wherever possible, contemplated procedures should be fairly automatic in their application, deliberate thought not being a requisite to any marked degree.

Organization and Transactions

In order to secure at different points the desired results as to internal check, it is essential that each department be connected closely with certain of the business transactions. An organization of some kind must be in existence in order to consummate business transactions, regardless of what may be the particular type assumed by a business enterprise. Since organization is built upon personnel which counts most in attaining commercial success. In some manner, each employee is related to the general scheme of organization, and, in turn, this organization plan is related closely through the members of the personnel to the transactions; completed transactions have direct effect upon the profit outcome.

The transaction of a business may be grouped in various ways, yet for present purposes the following divisions or classes are satisfactory, these coinciding closely with the separation of the general theory advanced above:

1. Purchases and purchase returns.
2. Sales and sales returns.
3. Cash disbursements and the cancellation of contemplated cash payments.
4. Cash receipts and the return of receipts to senders.
5. Internal transfers authorized and revoked.

A satisfactory solution to a fairly complete system problem requires that the latter must be broken up along the lines suggested, but without at the same time forgetting, in the slightest detail, the relationship of all of the parts to the whole.

Transactions Related to Purchases and Purchase Returns

The purchase function fundamentally includes buying, receiving, and authorizing payment of purchases of material, labor, services, and sundry items; the transactions related to purchase returns must be included, also. Whatever may be the purchase routine, as to incoming goods, labor, services, and so forth, the various procedures must tie into the factors of buying, receiving, and approving for payment in a manner which is satisfactory to the particular situation. The making and booking of a particular purchase are not of present interest, at this time it is desired merely to indicate some points to which the attention should be drawn, looking toward the establishment, by means of the application, of the principles of internal check, of the requisite safeguards related to the purchase function.

Possibilities for fraud in buying materials are many and varied, the following being illustrative:

1. Adversely influencing the purchasing agent;
2. Bribing employees in the purchasing department;
3. Materials received may not reach the storeroom;
4. Materials received may be of inferior quality;
5. Invoices received may not be paid properly;
6. The detailed account may be manipulated fraudulently.

It is in connection with possibilities like the above that the systematizer should develop protective schemes whereby the business will not suffer to an appreciable extent, should one or more be attempted.

If the request to purchase originates in some section other than the purchasing department, the possibility of having the purchasing agent influenced against his best judgment by a bribe or by a commission may not be disastrous should it occur; every purchase order should be supported by a signed request coming from another department so that the purchasing agent will be prevented from doing almost as he pleases. This outside agency frequently is the storekeeper, as where he issues such a request to purchase when the minimum has been reached as to certain materials; again, if the purchase is out of due course, the original may come from some general executive.

Competitive bids will do much to secure an adequate check against the possibility of having the purchasing department employees accept a price without regard to whether or not it is justified by the circumstances; buying without having bids submitted first, should be curtailed to a minimum. Further, no one person should be permitted to select a vendor and place an order. One employee,

if possible, should send out the requests for bids, another should receive the replies and tabulate them, and a third should place the order. Again, it is frequently found that a list of bids must accompany each voucher before the latter will be approved for payment. These suggestions, however, should not be taken as meaning that the lowest bid is the one always to be accepted, since frequently other factors are more important than price.

Also, in furthering the scheme of protection by means of internal check, employees may be rotated infrequently between the various positions available, this applying with equal force to many of the positions other than those concerned with purchases. However, in this scheme there is a happy medium to observe; one should not become so enthusiastic over the rotation idea that its application will impair operation efficiency.

Material received may not reach the storekeeper if the system at the receiving and storing points is defective. Only after the actual incomings have been checked to the receiving report should materials pass to the storeroom. Again, employee rotation may be found effective because those in the receiving room, in the course of time, may become decidedly friendly with the persons attached to the storeroom, the two groups usually working in close proximity to each other.

Collusion between the receiving department and the purchasing department is a possibility to foresee, this arising through an attempt to have inferior material accepted. A close inspection of all materials received by some one from the production department is advisable, and during the manufacturing processes frequent inspection of product should take not only to detect inferior workmanship, but defective material as well.

When the invoice sent in by the vendor eventually reaches the accounting department, or wherever it is that the invoice checking is done, it is an excellent idea to provide for having it checked by one person, rechecked by another, and finally gone over by the one who is to authorize its payment.

In booking the accounts or vouchers payable, the accountant should not forget the matter of adequate control. The keeper of the accounts payable ledger, for example, should be prohibited access to the general ledger so that he cannot force his abstract or trial balance at will.

The purchase of services and labor cannot be received and vouched as material to insure protection against fraud therein. In some cases certain services may be covered by the issuance of purchase orders, but in others this cannot be done. Hence, in general, the internal check thereover will not be as satisfactory as may be desired. Except for the labor element, probably the only satisfactory protection will be that secured through deliberate audit procedure applied after payment rather than before. Whenever possible, tangible evidence of expenditure should be attached to vouchers issued for payment thereof.

The safeguards installed relative to returned purchases must have a fundamental resemblance to those set up for sales, since many factors involved are strikingly similar. When material is returned to the vendor, the possibility exists of having this material misappropriated, unless the matter rests with some one other than those connected with the receiving and storing functions. These departments should not be permitted to handle returns except upon definite instructions, which have been issued from elsewhere; and as many departments as possible should be brought into the scheme of protection.

Transactions Related to Sales and Sales Returns

The points concerned with sales relate roughly to such matters as prices, discounts, outgoing bills, freight on outgoing goods, booking of sales and customers' charges, selling expenses; and as to sales returns, brief comment is offered only in connection with credit memoranda and the inward control over returns.

Even where standard sales prices and discounts are in force, the possibility exists that occasionally an unauthorized change herein may occur, by virtue of which some one will benefit surreptitiously, unless the two activities of preparing billings and making sales are separated. If the billings are prepared by some one other than a person concerned with sales responsibility, unauthorized changes should be uncovered quickly, for even a fairly efficient billing clerk will notice discrepancies between the usual prices and discounts and those passing directly under his attention. Being held accountable for errors in the billings, it is fairly safe to assume that such discrepancies will be reported by him, unless it should happen that collusion occurs between some sales department representative and this clerk.

Where sales relate to job work, it is possible to formulate some means whereby the prepared estimate may be used as a check against the actual charges made, provided that such estimates have been prepared otherwise than in the sales department.

Errors are of frequent occurrence in the actual preparation of outgoing bills unless provision is made for a proper checking thereof prior to issuance. The components of a shipment often may be wrong unless quantities, items, vendee, and prices are checked closely, this work being done, say, by two persons acting separately without regard to

the result obtained by either of them. Wrong prices and wrong units may be caught before it is too late by making provision for a double checking against sales orders.

Then there is the possibility of confusing a shipment upon which the freight is to be prepaid, considering it as one upon which a prepayment is not in order—or vice versa. A double check of some kind should be developed to avoid an error of this type; perhaps the functioning of a traffic department will be sufficient for this purpose, where such a department exists.

When an invoice has been sent out, the sale transaction is ready to flow to the books as an account receivable. At this point, adequate control should be established over the subsidiary customers' ledgers. One important problem at this point concerns making certain that all charges reach the ledgers—lost invoices and carelessness are responsible for the happening of such a thing.

The control of selling expenses often causes considerable trouble. Salaries and commissions do not offer much serious chance for fund misappropriation, whereas the items of advertising and sundry expenses may cause the accountant some worry before anything like adequate control is developed. The sales manager may be required to authorize expenses of a sundry nature, and it may be possible that bribery in placing advertisements will be curtailed through advocating the use on only well-known mediums.

The issuance of unauthorized credit memoranda is a fruitful source of trouble at times, and yet if the duties of keeping the customers' ledger is divorced entirely from those of the cashier, this difficulty, at best, ought to be of small consequence. The issuance of all credit memoranda should be authorized in the sales department, and what is done therewith subsequently should follow closely the handling accorded a purchase invoice.

Articles which have been returned are apt never to reach the warehouse of the factory unless some scheme is formulated under which a return cannot be lost or disappear, without quick detection, until it has been checked in definitely so that some one may be held strictly accountable for the value involved.

Transactions Related to Cash Disbursements

Hereunder, particular reference is made to disbursements from petty cash, disbursements by check, transactions related to freight, and canceled cash payments.

Payments from petty cash are protected best through the proper use of the imprest system. Prior to each replenishment of the fund, all petty cash vouchers should be approved by some official who will not be lax in carrying out this duty which so often is looked upon as being trivial. If the petty cashier notices that the person who approves his vouchers is slipshod in carrying out this act, he is most apt to devise some means whereby portions of the fund will find their way into his pocket. Vouchers presented for approval should be so marked and defaced that they cannot be utilized, in any fraudulent purpose; if they are filed away after approval, this act should be at the hands of the petty cashier, and the repository should not be accessible to him.

Check disbursements are protected easier than payments from petty cash. The cashier should have nothing to do with preparing and approving vouchers for payment; he should sign no checks; checks should carry more than one signature; and the signing of checks should not be treated in a perfunctory manner by those whose duty it is to sign them.

If a check is to be issued in payment of something which is not covered by an invoice, some major official should approve the voucher which is prepared for such purpose.

Incoming freight charges should relate to goods actually received. Hence, freight bills should be matched against goods received, say, in the receiving department, and the receiving department, and the receiving report numbers should be attached to these bills before they are passed along. The internal check should make it impossible to pay a bill twice.

Outfreight charges should be matched against the bills of lading, and protection should be afforded against a double payment.

When the cancellation of a cash payment is necessary, the routing should prevent an eventual double payment.

Transactions Related to Pay-rolls

Although the subject of pay-rolls has been developed previously, a brief comment at this time may not be amiss. The essential factor here seems to be to have the timekeeping entirely separate from the paying of the men. And then the internal check features should guard against the occurrence of such matters as:

Padding;
Withholding unclaimed pay;
Failure to drop from the rolls employees no longer in the place;
Placing employees on the rolls before they have been actually hired and put to work;
Falsification of earnings;
Falsification of pay-roll footings;
Withholding amounts refunded for overpayment;
Falsifying amounts paid out for underpayment.

The system procedures should not permit a person to pay off the men if that person has any control over the amount of money to be drawn from the bank, and the person whose duty it is to

pay off should have no connection with preparing the pay-roll. Pay-roll checks never should be for round amounts. Time clocks should be utilized to record in and out time, and this record should be checked against the labor tickets prepared for the work actually done each day; otherwise, one employee easily may punch the clock for another who has taken an unauthorized holiday without the discovery occurring automatically. If automatic clocks are used with which to stamp the starting and stopping time of jobs on the labor tickets, dummy tickets cannot be passed for an absent employee without such a fact being discovered.

The ordinary precautions provided through the installation of an efficient pay-roll system will prevent padding and will detect the carrying of an employee on the rolls after he has been dropped, provided the duties of timekeeping and paying off are separated clearly. Careful checking of clock cards, labor slips, and employment records, as a matter of routine, should prevent collusion between employee and timekeeper that would cause monetary loss to the company.

Falsifying the pay-roll footings is not going to cause a loss if the paymaster has nothing to do with preparing the pay-roll—at least, the paymaster cannot benefit by such an act.

The pay-roll problem is a serious one, worthy of considerable thought in each case, to the end that procedures may be developed which will reduce peculation possibilities to a minimum.

Transactions Related to Cash Receipts

Cash is received primarily from cash and charge sales; infrequently, a return of a receipt is necessary. The methods by which a cashier may abstract cash are many, some being rather difficult to detect unless the internal check is adequate, and others showing up either almost automatically after a time, or at least as a result of specific audit. Some require no collusion by the cashier with another person, even though the receiving function is divorced from that relating to entry, and others cannot be carried out to any serious extent without help. Fundamentally, in order to make the misappropriation of cash difficult, incoming moneys should never be handled by any one who has access to the customers' ledgers.

The actual stealing of cash without record falsification is discovered readily when the bank statement is received and reconciled against the books. Withholding receipts without entry may go undetected for a time where the cashier can change or suppress monthly statements to customers, but eventually their complaints should cause discovery. Delaying the entry of cash received (lapping) may be stopped by depositing all receipts intact each day, and by requiring duplicate deposit slips to be made out, the bank-stamped duplicate going to some official direct so as not to reach the cashier's hands. Checks for accommodation should never be cashed from undeposited moneys.

The cash book may be written up in detail correctly, yet the totals may be false—as reduced for general ledger posting—if collusion exists between the cashier and the entry clerk, so that abstract of the customers' ledger will agree with the control. This may also occur where the functions of cashier and ledger keeper are combined in one person. The overstatement of customers' discounts on the cash book may be deliberate in an attempt by the cashier to appropriate personally the difference between actual and reported discounts amounts. Where this practice is confined to currency receipts, detection may be difficult; but if it is applied to other receipts, detection should be possible by means similar to those used to uncover lapping, unless there exists an understanding between the cashier and the customers' ledger clerk; otherwise, the latter is apt to draw the attention of some one quickly to the discrepancy between the discount rate in use and that shown by the cashier. Accounts of delinquent customers should be cared for properly, so that an arbitrary charge-off is impossible; in fact, all journal entries should be approved officially—that is, those placed upon the general journal. Other possibilities for fraud might be mentioned, but the above seem sufficient for illustration, and for emphasizing the fact that the cash receipts phase of a case should be carefully studied in view of what it involves.

Duplicate sales tickets should be prepared for all cash sales, so that the customer may receive the original and pay the cashier therefrom, the duplicate being retained by the sales clerk, and being sent later directly to the person who is responsible for its audit. All blank books not in use should be safeguarded carefully.

Where cash receipts are the main course of revenue, the charge sales being fairly incidental, the proper protection may be difficult to secure. Cash registers in themselves may not afford an accurate check. Short- and long-changing customers, particularly during rush hours, frequently develops a problem that is difficult to solve.

Transactions concerned with the return of cash receipts need not cause much trouble, provided the usual protective cash procedures are utilized, and the keeping of the customers' ledger is eliminated from the cashier's sphere of influence.

Internal Transactions

These occur only within a business, being reflected by a charge to one internal account and a credit to another—as goods going from process to the finished stock-room, and so forth. In a large

(*Continued on page 69*)

Pedrara Quarries Supply Much of the Onyx Used in the United States

By GEORGE P. BROWN

PEDRARA Onyx, almost a jewel and nature's most beautiful stone, has been extracted from these quarries, and sold throughout the world, for the past thirty-five years; and the deposits developed and being developed, assure continuous production, in the future, for another generation.

The Pedrara quarries are located in Lower California, Mexico, 330 miles southeasterly from San Diego, California, by automobile road, and fifty-one miles inland from the Port of Santa Catarina, on the west coast of the peninsula. The elevation from the Pacific Ocean being 2,400 feet.

Onyx road to beach

The quarries are owned and operated by the South West Onyx and Marble Co., an American company, with manufacturing plant and offices in San Diego, California. The holding company in Mexico is the New Pedrara Onyx Co., protocalized there; and holds title by patent deeds from Mexico during the regime of President Diaz, dating back to 1905.

There are 5,000 acres in the holding, and the deposits of onyx lie within an area of approximately 500 acres of this holding.

A 4-ft. stratum of onyx

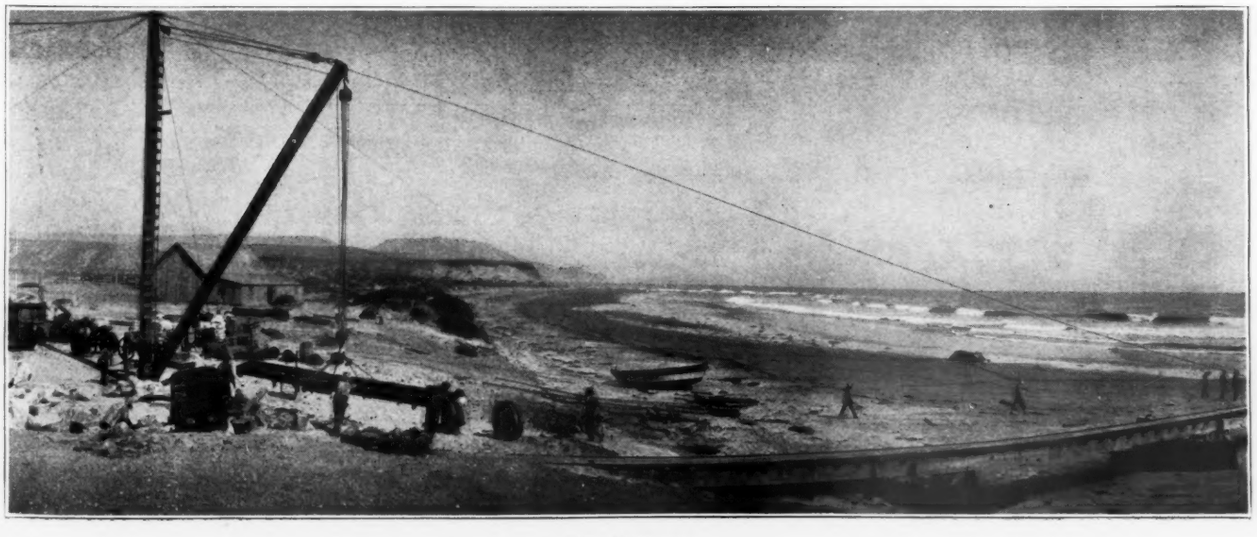
The largest deposits are on a mesa, about forty feet in height, a length of about 3,000 feet and a width of 1,200 feet. Here all deposits join on with the other.

A Commercial and Industrial Survey, published by the United States Department of Commerce, on Mexican West Coast and Lower California, page 325, among other things, says:

"The west coast of Lower California produces what has been termed the best onyx in the world. Blocks of any size can be quarried out for shipment, so that there is no limit to its commercial usefulness.

"The onyx marble formation is travertine of the calcite group of carbonates and is 96 per cent carbonate of lime.

"Low grades are found in Arizona, Nevada, Missouri and Mexico. The onyx of Arizona cannot be



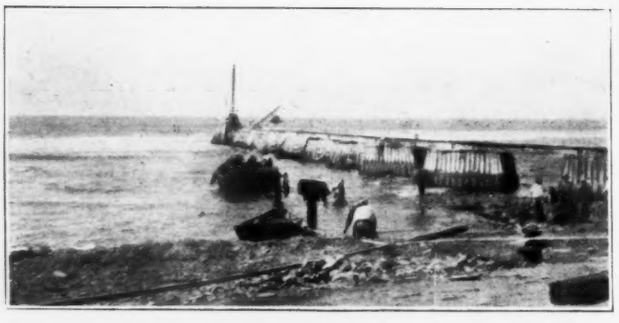
Beach camp

Lighter preparing to load at wharf

Surfing onyx to vessel

quarried in large pieces; that of Nevada is of muddy color; that of Mexico is said to be too brittle for shipment, of heavy coarse grain and two highly colored."

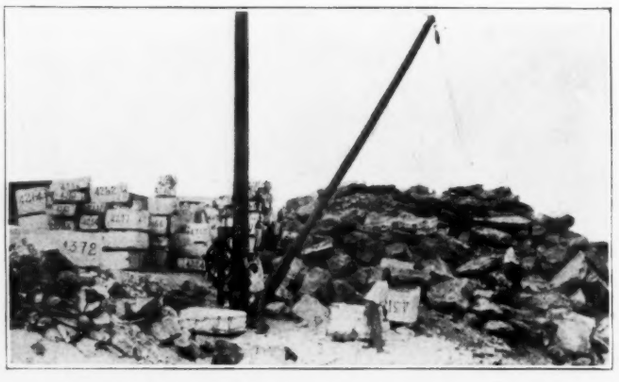
In all the deposits developed, three strata of onyx are found; the upper stratum, usually near the surface, is thin, highly colored, and mostly used for novelty work, such as automobile gear shift balls and knobs, pen bases, lamp fittings, tile, ash trays, book ends, candle sticks, and illuminated perfume containers.



The wharf at Santa Catarina

The second stratum is from one to two feet in thickness, furnishing novelty and block onyx; and the third and lowest stratum found furnishes the large commercial block onyx, ranging from one to four feet in thickness, and, from which stratum, blocks for bank and theatre fixtures, hotel lobbies, soda fountains and mantles are quarried.

This lower stratum rests on a cemented conglomerate bed rock and no onyx has been discovered by the drilling done below this bed rock.



Derrick in onyx quarry

In quarrying "plug and feather" work is used for breaking out the blocks; no powder used, except on removal of overburden. Compressed air, furnished by two semi-portable compressors, is used for all the drilling; the squaring of blocks is done by hand. Five derricks and two Fordson tractors, equipped with Ersted hoists for dragline and scraper work, complete the equipment.

The transportation is the great problem at these quarries and 5-ton Moreland trucks, with trailers,

Showing quarry and some of the natural surface

Showing stratification of the onyx

are used to haul the blocks to the landing 51 miles from quarries, the road has to be maintained by the company.

The round trip for trucks takes, with the loading and unloading, two and one-half days.

From the beach landing at Catarina, where all onyx is stored when hauled from quarries, shipments are made by vessels owned by the company once or twice per month.

Here a 400-ft. wharf, on which are three Standard, stiff-leg derricks with 40-ft. mesh and 30-ft. booms, is built, and large seagoing lighters, running on a surf line, manned by six men to the lighter, take the onyx from the end of wharf to the ship, which lies beyond the breakers about 1,500 feet.

The products from the quarries are all shipped to San Diego and placed in the U. S. bonded yard there for sale throughout the world. An import duty of $6.50 per ton or 65 cents per cubic foot is paid the U. S. Government. The production for several years has been about 25,000 cu. feet per year. The Pedrara quarries have reasonably in sight 1,500,000 cubic feet of onyx.

El Marmol, B. C. Mexico, is the name of the camp and has a population of about 300 people. The company has built and maintains all houses and school buildings, and workmen and families are given houses rent free. Water for drinking has to be hauled from three to ten miles in 1,000-gallon tanks. A hospital and doctor are in camp for any sickness or accident. Two school rooms contain 70 children of school age, the company furnishing buildings and equipment, and the Mexican Government furnish two excellent teachers.

About 100 men have been on pay roll the past year, and all are Mexicans except the general superintendent. The climate permits work throughout the year. All supplies are shipped by vessel from San Diego and Ensenada, B. C. Mexico, the port of call, sixty-five miles below California.

F. W. Martin of Sargent and Lundy read a paper, "The Diesel Engine—Its Place in Industry," before the Western Society of Engineers, Nov. 18.

Methods in France

(*Continued from page 62*)

stirring and assures a regular production, it still requires a high fuel consumption.

It has consequently also been replaced by the rotary kiln, similar to the cement kiln, fired either by pulverized coal or, preferably, by producer gas. The use of water gas for the firing dispenses also with the addition of coal to reduce the sulphate, or makes it possible to diminish its proportion, and yields a sulphide of better quality. The operation of the rotary kiln is continuous and the net cost is much less than with the two preceding types, but, to obtain a complete reduction, the kiln must be well regulated and supervised. When electric current is available, and this is generally the case in regions where the barite deposits are found, it is of advantage to use the electric furnace, particularly in small and moderate sized plants.

Warm barium sulphide oxidizes easily in contact with the air, regenerating the barium sulphate; consequently it must be cooled as soon as possible. One indisputable advantage of the rotary kiln with gas firing is that by a simple arrangement they make it possible to cool the sulphide in an essentially reducing atmosphere, at the same time recovering the heat from the mass of sulphide.

The diminution in weight at the time of the conversion of barium sulphate to the sulphide being at least 25 per cent, it would be of advantage for this process to be done in the vicinity of the mines, to reduce freight charges.

The solution of barium sulphide makes it possible to obtain all the compounds of barium. By boiling with zinc oxide, it yields barium oxide, with precipitation of insoluble zinc sulphide. By passing a current of slightly moist air (but thoroughly cleansed of carbonic acid) over this oxide at a dull red heat, the dioxide of barium is obtained. Treated with hydrochloric acid, nitric acid, or carbonic acid, it forms the chloride, the nitrate and the carbonate of barium, with elimination of sulphureted hydrogen. All these barium products have numerous industrial uses.

Internal Check Factors

(*Continued from page 66*)

concern, internal transactions are practically numberless. Their accurate handling is important if for no other reason than that it is essential that each department be charged with its proper costs. The records of one department frequently may be utilized as a check against the accuracy of those in another—for example, the purchase record has a relationship to the values going under the control of the storekeeper, and the summary of materials issued and returned to stores has a direct connection with departmental charges covering such items.

Developement of the American and Canadian Gypsum Industry*

By R. M. SANTMEYERS,

Mineral Specialist, U. S. Bureau of Mines.

DURING the last decade the consumption of gypsum has increased rapidly in the United States, but the ability of American and Canadian mines to produce has increased even faster. The industry has been active in research leading toward enlarging the field of its products and in educating architects, builders, and the general public with regard to the desirable features of gypsum materials. These efforts have been successful and promise to be even more so. Another stabilizing factor within the industry is the tendency of manufacturers to diversify their products. A manufacturer who has a complete line of specialties to fall back upon during an off season or a depression in the construction industry is better able to keep his plant well occupied throughout the year. During very recent years a number of new gypsum product specialties have been brought forth, many of which are closely identified with the individual manufacturer producing them—an excellent safeguard which appears to have a profitable future.

In the past year or so several manufacturers have put forth building plans or begun actual construction of gypsum plants at strategic points, especially along the Atlantic seaboard and bordering the Great Lakes; a few of these plants are already in operation. The location of plants at such points will have a tendency further to acquaint the metropolitan areas with the merits of gypsum products —especially those pertaining to building construction—and should enable the market to be thoroughly covered at less cost than formerly when sales efforts were directed from plants situated several hundred miles away from points of delivery.

The tendency within the industry today seems to be for concentration in the more thickly populated areas, and for consolidations involving two or more of the smaller producing companies.

Production

A study of the statistical record of production of crude gypsum will furnish an idea of the rapid increase in the use of this mineral.

At the beginning of the last decade of the 19th century (1890), the total production of crude gypsum mined in the United States had reached the then exceptionally large figure of 182,995 short tons, valued at $574,523, or an average of $3.14 per ton. Since that year, the industry has shown a generally steady increase, with the exception of the war years, to a maximum in 1925. Even during 1917 and 1918 the decrease was not as great as in some other basic industries, due to the continued demand for fireproofing materials usable in rapid construction, as in factory and munitions buildings, cantonments. etc. It was during this period that the use of gypsum roofing slabs, precast or cast on the job, partition tiles, and plaster board came into prominence as building materials; ease and rapidity of construction, relative cheapness of materials, and unusual fireproof qualities played the major part in increasing the demand for these products.

The sales of crude gypsum have been increasing proportionately with production of the crude rock. Because of the great increase in manufacture of Portland cement, the industry consumes larger quantities of crude gypsum as a retarder today than ever before, requiring 969,357 short tons of the total of 999,412 tons of crude gypsum used for all purposes in 1928. The use of ground crude gypsum as agricultural fertilizer or land plaster, however, has been showing a steady decrease during the past decade.

The greatest use for gypsum is in the production of calcined gypsum from which practically all of the manufactured products are made. This use has increased from 79,257 tons, valued at $412,361 in 1890, to 3,641,385 short tons, valued at $30,134,129 in 1928. In 1925, the peak year, 4,096,357 tons were used, valued at $44,754,011.)

The following table shows the production of gypsum in the United States, by States, for the years 1890 to 1927.

Gypsum Industry by States

While gypsum is found in practically all sections of the United States, only certain states are exploiting their deposits. In some states the deposits are small or low grade, while in others, though the gypsum may be suitable for economical mining, the market requirements are not large enough to warrant the erection of plants for the manufacture of gypsum products.

New York, Iowa, Michigan, Ohio, Texas, and Nevada, in the order named, are the largest producers.

* Excerpts from U. S. Bureau of Mines Information Circular 6173.

Accident Hazards From the Use of Conveyors About Pits, Quarries and Plants

By W. DEAN KEEFER
Director, Industrial Safety Division, National Safety Council

THE increasing use of mechanical conveyors has done much toward speeding production in the quarrying industries. In one sense, this has resulted in the reducing of accidents, since mechanical conveyors nearly always replace hand labor and thus lessen the number of men on a particular job and decrease the man-hour exposure.

This increased use of conveyors has introduced new hazards. For example, three of the 33 fatalities reported by the cement industries for the year 1928 were directly due to accidents with screw conveyors.

The cement industry—due largely to the organized accident-prevention work conducted for a number of years—is listed as the least hazardous of the seventeen different sections of the Industrial Safety Division of the National Safety Council. The accident frequency rate for 1928, for the 130 cement establishments (with a total of more than 82,000,000 man-hours of work) which reported to the National Safety Council, was only 7.47 lost time accidents per one million man-hours worked, as contrasted with an accident-frequency rate of 24.52 for all of the 2,557 industrial establishments which reported to the National Safety Council for that year.

This is a splendid record, both as compared with other industries which would seem to be much more hazardous, and as showing an advance in accident-prevention achievements within the industry, since the accident-frequency rate of the cement industry for the year 1919 was 43.47.

In contrast, the quarry industry does not have as good a record in accident prevention. The average accident-frequency rates for the 56 quarry establishments which reported to the National Safety Council for 1928 was 39.57, as compared with the previously mentioned frequency rate of 24.52 for all industries, and the rate of only 7.47 for the cement industry. However, this accident frequency rate represents a sharp reduction from the frequency rate of 48.56 reported by 36 quarry establishments to the National Safety Council in 1925.

As might be expected, the accident-severity rate—that is, the number of days lost per 1,000 man-hours worked—for both the cement and the quarry industries, is comparatively high. The accident severity rate for the cement industry for 1928 was 3.96, and for the quarry industry for 1928 was 4.76—as contrasted with an accident severity rate of 2.03 for all of the 2,557 establishments reporting in 1928.

As stated, the use of conveyors in the quarry industries has doubtless resulted in lowering the frequency of accidents; but conveyor accidents, when they do occur, are likely to be quite severe. This is well illustrated by some of the reports concerning conveyor accidents made before several sessions of annual safety congresses. A speaker before 1929 congress said that "One of the most common and effective means of transporting the different materials that go to make portland cement, is the screw conveyor. This device is particularly dangerous to human life and limb and, from the early days of its use, has contributed heavily to the record of accidents in the cement business, many of which have ended fatally."

This speaker listed a number of specific things which his company was doing toward the elimination of screw-conveyor accidents. First, when it was necessary to shut down a conveyor for repairs, it is the plant rule that the operating mechanism of the conveyor shall be securely locked. This rule, he stated, "is strictly enforced and is applicable to all types of machines for a shut-down for any cause whatever, either mechanical, electrical or operating."

It is a further rule, with this company, that when spillage and sweepings from the floor are returned to a conveyor they must be returned through an opening protected by a screen or grating which is bolted down. Samplings from conveyors while in motion is prohibited. Good housekeeping, and the safety education of their employes, are listed as further safety measures of value. Dirt and rubbish are not allowed to accumulate in large or small quantities near the conveyor boxes. He lists "a plant spirit of safety" as the final necessary condition for the prevention of such accidents.

At a previous session of an Annual Safety Congress, one of the speakers described the methods which had been used by his company for the prevention of conveyor accidents.

"We have screw conveyors in our tunnels, I presume very much like those existing in other plants." In the last 20 years two fatal accidents occurred. We had a condition where materials would flood the conveyor, lift the lids, shift them, or even tear them loose from their moorings.

"Finally, we decided that, from a mechanical equipment standpoint, we would make that particular thing fool-proof. Bar grates were made and put over the conveyor and bolted down in such a way that it would take an employe a long time to unbolt them. These bar grate covers will stand a severe twisting of conveyor screws before they become loose. They are fastened to anchor lines and bolts. Whenever we have a possible flooding condition we have those grates bolted down. They are bolted down securely so the conveyor will tear before the grates give way, and there is a strict order that no employe has anything to do with those except the foreman and the special repairman; so if anything goes wrong with the conveyors we know who is responsible. It is the duty of the foreman, when he knows that work is being done on the conveyors in a tunnel, to make a personal inspection, besides having the report of the special repairman for that job."

Other types of conveyors in use in the industry also have their hazards. For example, a publication of an insurance company summarizes the problem as follows:

"Gravel pits operate many heavy belt and chain conveyors, all extremely dangerous and made more so by their comparative isolation. If a man does get hurt it generally is a serious case. But such conveyors can be well guarded at small expense."

"The business is rendered more difficult from an accident prevention standpoint," continued this report, "because of its similarity to a general contracting business, where makeshift installations prevail, although this should not be. Even though the equipment is similar to that used in some branches of contracting, it is, in the case of gravel pits, of a more stable and fixed nature—the installations are of a much more permanent nature and therefore could and should be of a much higher grade and protected to as high a degree as in a factory."

Toward the lessening of hazards in the use of conveyors, the National Safety Council has published a Safe Practices Pamphlet on "Conveyors." This pamphlet is a compilation of experience in accident prevention, prepared by a special committee and reviewed by a conference committee consisting of about seventy-five safety engineers.

One of the first general suggestions of this publication is that no adjustment or repairs of any kind should ever be made while a conveyor is in motion. It is advisable that all oiling of such equipment should be done through the use of pressure oiling and greasing devices or in such manner that the oiler will not come within dangerous proximity to moving parts.

It is advised that all switches for conveyor power machinery, when shut down, should be locked or protected by warning signs, and there should be a rule forbidding any one to remove the lock or a warning sign, except the person who places it.

All long conveyors should be provided with automatic controls, switches at suitable points, or cables permitting these conveyors to be stopped quickly in emergencies. Gongs or whistles or speaking tubes often are essential to give warning previous to the starting of a conveyor line after it has been shut down. All parts of power-driven conveyors, on or in which persons might become caught, should be guarded with enclosures or substantial railings. Workers should be forbidden to cross exposed conveyors except at regular cross-over points. At all such locations there should be an elevated bridge or a tunnel, or at least special protective devices to guard against stumbling or contact with moving parts.

All belts, pulleys, chain and rope drives of conveyor equipment, whenever located within seven feet of the floor or a working level, should be effectively safeguarded. All gears should be completely protected. Sprocket wheels and chains should be properly enclosed. Projecting ends of shafting should be guarded or removed.

Insurance companies report that one of the greatest sources of accidents from overhead conveyors is through the falling of materials.

There is increasing use of belt conveyors in the handling of sand, gravel and crushed stone, and it is important that the driving mechanism of belt conveyors be properly safeguarded. The conveyor belt and trough should also be railed off or otherwise protected, so workmen will not attempt to cross over or ride upon the belt.

One of the outstanding dangers from belt conveyors is that workmen are tempted to clean off materials that stick to the tail drums or the pulleys while they are in motion. Fixed scrapers and revolving brushes are sometimes used to make it unnecessary to perform this operation by hand.

Loading hoppers, as a part of a belt-conveying system, reduces the hazard from falling material, but care should be taken that hoppers are rigidly fastened in place. Workmen should be cautioned to use care in dislodging material when trippers or automatic discharging stations for belt hoppers become choked up.

When automatic trippers discharge into bins directly under them through holes in walkways, it is usually best to cover these openings with gratings just large enough to prevent the material coming from the conveyor to pass through. With chain conveyors, the return portion of a chain or cable should be effectively guarded against contact.

Each type of conveyor in use in the quarry industry has its special hazards that demand continuous watchfulness.

(*Continued on page* 78)

Separate Plants Produce Sand and Gravel for Local Consumption in Denver

Gordon Company Prepares Dry Aggregates

By JOS. C. COYLE

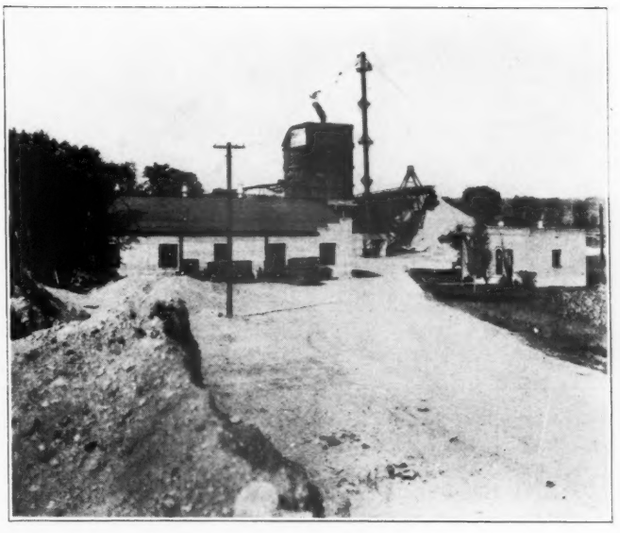
CONDITIONS are constantly changing in the industrial world and, to offset this, production methods must also undergo changes from time to time. This is true in the production of sand and gravel, as well as in other industries. Such changes, made by the Gordon Sand and Gravel Company, of Denver, which operates two of the largest and most modern plants in Colorado, have brought these plants to a high standard of efficiency and have improved the company's service to the public.

In the first place, the trend of construction methods has, for some time, been toward the use of continually better materials. Sand and gravel must be clean, and it must come up to certain specifications. During the past year the demand for dry sand has been particularly noticeable in and about Denver.

The firm realized from the first that local conditions called for the erection of two plants: one on the Platte river, as near as possible to the center of demand, for the production of sand; and another, on Clear Creek, near the suburbs, where an excellent grade of rock was available. There was little rock in the Platte river sand and what there was would not do for market. Clear Creek rock contained large quantities of sand, but it was unfit for the market. Special equipment and frequent improvements in operation methods have solved the problems at both plants.

The Rock Plant

Originally both plants were supplied, by cableway and dragline, from wet pits. In the case of the rock plant—the one on Clear Creek—conditions forced a change to a dry operation. It was either this change or move the plant, so a few months ago the change was made. At this plant the company owns 140 acres of gravel deposit which is about 25 ft. deep. A small portion of this deposit carries an overburden of from 1 to 6 ft. This overburden is removed with a Monighan No. 20 dragline and is piled back of the face, where the gravel has been removed. A new opening has been made near the plant, and a track built to accommodate 4-cu. yd. side-dump cars built by the Western Wheeled Scraper Company.



Garage and office, with pit-run storage in foreground, Platte River plant

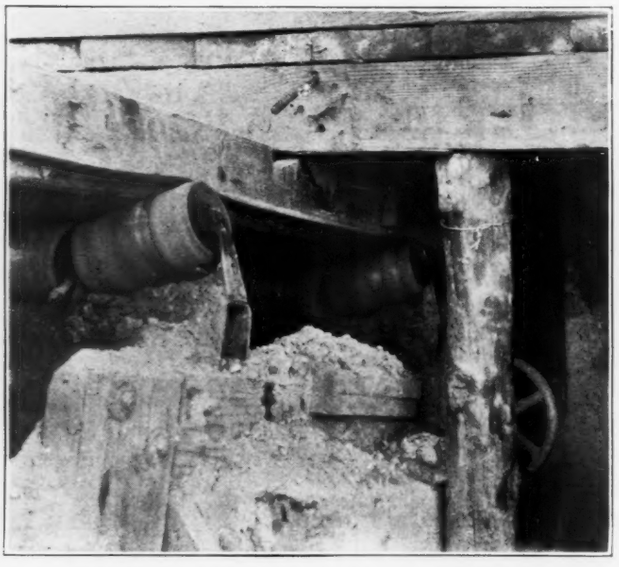
Dry pit at rock plant, with dragline and shovel in distance

Twelve trips per hour are made with these cars, which are pulled temporarily by a Thomas 120-hp. two-drum hoist with a 75-hp. motor. When the workings have progressed farther, this and the cars are to be replaced by a conveyor.

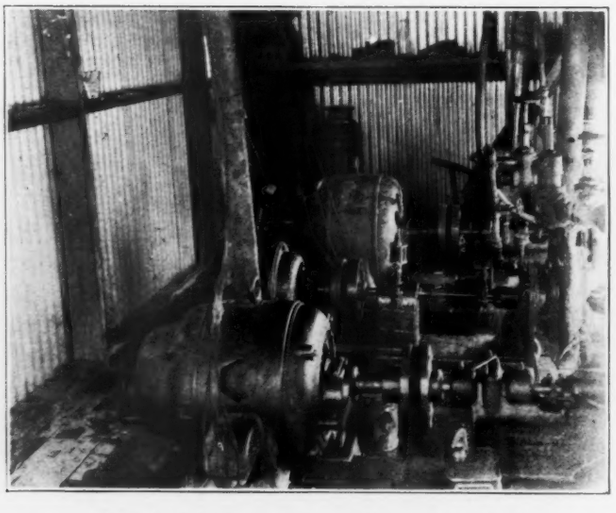
The end of the track is on a fill, so that the cars dump onto a 4-ft. by 8-ft. grizzly, through which the material passes into a hopper over the end of a conveyor belt. An adjustable metal gate allows the material to pass into a home-made automatic feeder, which distributes it onto the belt.

This is an 8-ply belt, 30 in. wide and 460 ft. long between centers, running on Link-Belt rollers with Timken bearings, and driven by a 40-hp. General Electric motor. This motor is on the ground beneath the belt, about midway, and drives the latter by a short belt to a triple-gear arrangement with two pulleys. Nearby are three other

Storing coarse concrete sand with dragline scraper



Conveyor pit beneath grizzly at rock plant



Electric-driven pumps in pit at rock plant

pulleys, over which the conveyor belt passes. The lower of these three pulleys is mounted in a frame with a heavy weight attached. This pulley is arranged to slide up or down in the frame, thus keeping the belt automatically tightened. Some of this belt is Goodrich make, and the balance is Goodyear make.

The material drops from this belt onto a grizzly at the top of the plant, whence it flows by gravity over a ½-in. screen. Pea gravel and sand dropping through this screen pass directly to a waste flume. Material passing over the screen flows through a chute into a 15-in. opening in the back end of the Bartlett & Snow scalping screen, which is driven by a 7½ hp. Wagner motor through Foote gear reducers with remote control. A metal gate in this opening, operated with an extension rod from the front end of the screen, controls the flow of rock. The screen is 4 ft. in diameter by 12 ft. long. Five feet of this is equipped with baffles and serves as a scrubber. Two 2-in. streams

Storage at Gordon rock plant

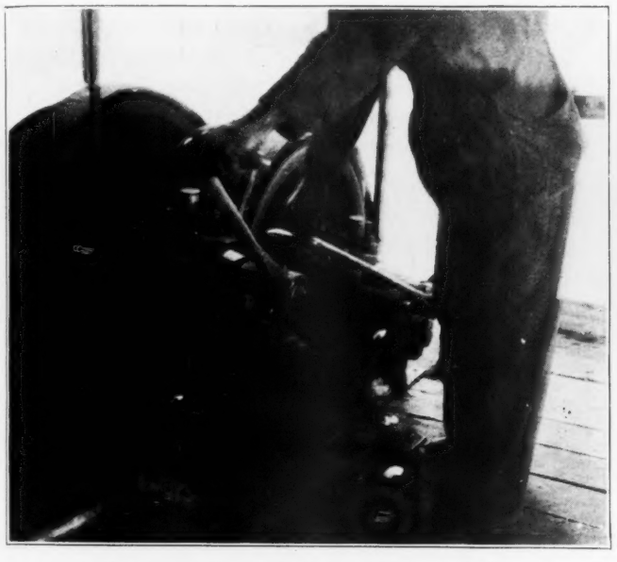
of clean water play upon the rock as it passes through the screen, resulting in an extraordinarily clean grade of rock. Oversize rock passes over the end of this screen into a 15-in. by 24-in. Universal crusher driven by a 50-hp. General Electric motor. A sand-jacket, 9 in. outside the scalper, diverts the rest of the salable rock to the big sizing screen below, while the sand passes through into a waste flume and back to the creek.

The Austin sizing screen is 26 ft. long by 41 in. inside mounted on 36-in. trunnions and driven by a 20-hp. General Electric motor. Eight feet of jacket has 1¼-in. round openings. Outside of this is another jacket, ½ in. thick, with 9/16-in. holes, and outside of this second jacket is a ¼-in. wire mesh. The rest of the screen has 2-in. round openings. One grade of gravel passes through the 1¼-in. openings into a bin, or is bypassed to storage outside of the plant. The other grade passes through the 2-in. openings, to be taken care of in the same way. Oversize rock passes over the end, and flows by gravity to a 12-in. by 24-in. Universal crusher, and then into the boot of an 18-in. bucket conveyor, on 47-ft. centers, furnished by the Western Belting & Supply

Company. This carries the rock back to the top of the plant. Both elevator and crusher are run by a 20-hp. Westinghouse motor.

Bin capacity of the plant is 50 cu. yd., with outside storage of 15,000 cu. yd. A high board-fence through this storage yard divides the two grades of gravel. The latter is both stored and reclaimed with a Sauerman ¾-cu. yd. drag scraper and a two-drum hoist, operated from the second floor of the hoist room with 15-ft. extension levers, so as to give the engineer a clear view of the operation. When reclaiming, a bucket elevator carries the gravel back into the bins from the side of the plant.

Abundance of clear water for the plant is furnished by two Fairbanks-Morse centrifugal pumps at the bank of Clear Creek. These are both operated by remote control and the discharge pipes are inter-connected so that, in case of emergency, it is possible to operate with one pump for a time.



Hoist that handles storage at sand plant

One 5-in. pump is run by a 30-hp. General Electric motor; the other, a 4-in., by a 20-hp. United States motor.

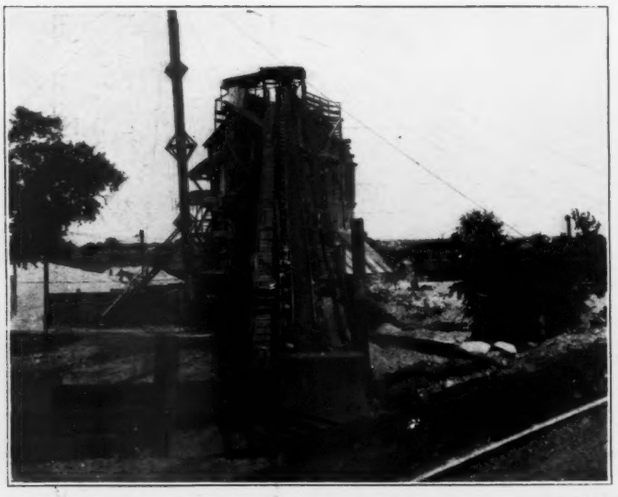
Besides these pumps three other centrifugal pumps are situated in the pit, for de-watering purposes. One is a 3-in. Jackson run by a 5-hp. General Electric motor; a 3-in. Fairbanks-Morse with a 7½-hp. Wagner motor; and a 4-in. Fairbanks-Morse with a 20-hp. Wagner motor. Normally one 3-in. pump takes care of the seepage. In wet periods the two 3-in. pumps are used, while the 4-in. pump is reserved for emergency. The pumps being inside a small building, an indicator gauge was placed on the discharge pipe outside, so that any employe passing by can see at a glance if the pumps are operating.

The cars are loaded in the pit with a Koehring shovel, and they return from the grizzly by grav-

Gasoline shovel in rock pit

Office at the sand plant

This dragline performs miscellaneous duties at the rock plant



End view of rock plant from point near grizzly

Screen and dewatering box at Platte River plant

ity. This method has proved considerably cheaper than a wet pit, because of the heavy percentage of quicksand, according to Willis Jones, manager of the plants. The present capacity of this plant is 75 cu. yd. per hour, and it is planned to increase this soon to 100 cu. yd. per hour.

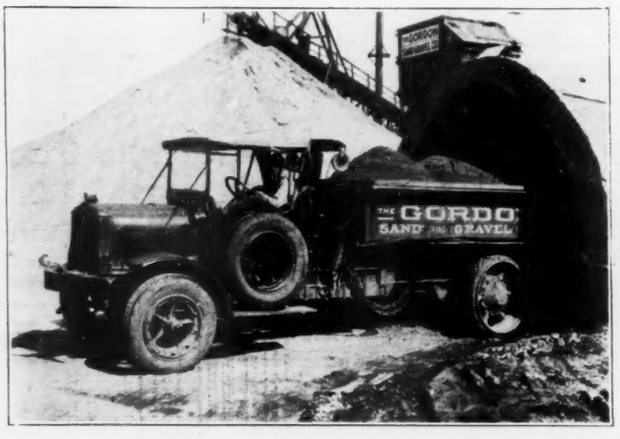
A feature which aids considerably in cutting production costs is the salvage of about 5 cents per yard in flour gold from the pit. This is done by placing strips of old screen in the bottom of the waste flume. These retain the fine gold which is contained in the sand, and now and then a "clean-up" is made.

The Sand Plant

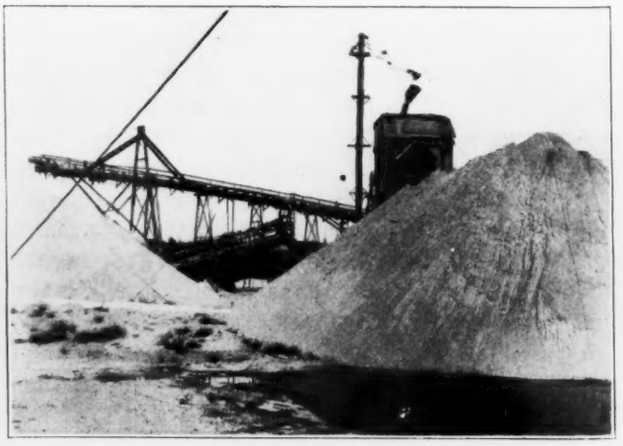
At the sand plant on the Platte river, sand is retrieved from the bed of the stream with a Sauerman slackline excavator and a two-drum hoist, driven by a Lincoln 80-hp. motor. The material dumps into a 150-cu. yd. bin at the top of the plant, whence it runs by gravity into a 21-ft. Austin revolving screen, 12 ft. of which is equipped with a sand jacket which is interchangeable. Sand passing through this 12-ft. section drops into a dewaterer; pea gravel passing the rest of the screen goes into a bin for sale; while a little rock and trash pass over the end to a waste flume.

A considerable amount of loam is sometimes encountered in the Platte river bed, and, to cope with this, a specially made dewaterer is used in this plant. It consists of a wooden box 4 ft. by 8 ft. and 4 ft. deep. Two metal wheels, 3 ft. in diameter and with blades 10 in. wide and curved sharply forward at the outer ends, are set in the front end of the box at a slope of about 45 deg., and turn in opposite directions. These serve a double purpose: first, of agitating the sand so that the loam may flow out through a number of 2-in. holes at the back of the box, and 6 in. from the top; second, to raise the salable sand over the side of the box to a Leahy vibrator screen and thence to storage.

Fine and coarse concrete sand are the principal products of this plant, the proportion varying according to flood condition of the river. There are also brick and plaster grades, the latter being the finer sand which passes through the Leahy screen into a loading bin beneath. Storage of brick sand,



Truck emerging from loading tunnel



Coarse storage (right) and fine storage (left), dragline bucket dumping into bin, loading bins (center), and storage conveyor

Pit-run storage yard, loader in distance

Side-dumping rock onto grizzly

a slightly coarser grade, is made when the river-run is of proper texture. The same is true of coarse and fine concrete sand, these three grades being that sand which passes over the Leahy screen.

For coarse concrete sand, there is a storage bin at the side of the plant for 150 cu. yd. and open storage for 50,000 cu. yd. This sand is taken to storage by a ½-cu. yd. Green drag scraper, pulled by a two-drum American hoist. This rig is also used in reclaiming sand to a concrete loading tunnel recently constructed across this storage yard, to provide a dry sand such as the public requires. This tunnel is 251 ft. long, 12 ft. wide, and 10½ ft. high, with a loading hopper every 17 ft. The tunnel has a slope toward the middle, where a sump is located for drainage. When the river is low the waste water naturally drains away through the porous sand. During high water the sump is closed and a pump removes any water which collects in the tunnel.

There is storage for 15,000 cu. yd. of the fine concrete sand, and when the plant is running on this, it is taken to storage over a Jeffrey 18-in. conveyor belt, driven by a 5-hp. General Electric motor, on a trestle. The sand is reclaimed to two Butler loading bins by similar Jeffrey conveyor, driven by a 7½-hp. General Electric motor, with boot beneath the stock pile. Both belts are run by a 5-hp. back-gear motor. The recent increase of storage facilities (the 50,000-cu. yd. coarse sand yard) has enabled the plant to cease production during winter and to still have ample sand on hand for all customers. About 20,000 cu. yd. of pit-run is also stored by the Monighan dragline, when the rock plant is not working, along the bank of the Platte, where it is loaded for delivery with a Haiss loader.

Twenty acres of land is owned by the company at this plant, the capacity of which is about 60 cu. yd. per hour. Water for the plant is furnished by a Fairbanks-Morse centrifugal pump, direct-connected to an Allis-Chalmers 35-hp. motor.

A concrete garage has been constructed to house the company's trucks and other cars, and one mechanic is constantly employed in keeping the fleet repaired. A neat office was also built nearby, and the area between concreted. A Bowser self-

The hoist room at the sand plant

Enclosure for motor drive to main conveyor at rock plant

Truck fleet in garage

measuring pump, with a 1,000-gal. underground gasoline tank, is used in servicing trucks as they return in the evening. A gasoline register, attached to the pump, and inclosed in an Armco iron box, shows the gallonage on a tape, as each truck is serviced.

Four 6-cu. yd. Macks and four 5-cu. yd. Whites are used, and all are painted a peagreen and yellow, making a lasting and attractive appearance. All are equipped with service recorders. Besides the company trucks, from 10 to 20 other machines are employed. Trucks are dispatched from the office at the Platte river plant, where four copies of each order are made out before each driver leaves. One of these, the driver's copy, is stamped with a time clock, in and out of the office, so that a record is always on hand of the exact time required to make a trip. In addition, each driver is required to record any unforeseen delay on the back of the ticket. These records are also transferred to a book each day.

Diatomaceous Earth in the Pacific Northwest

Since the development of the large deposits of diatomaceous earth in southern California and the increased number of uses of this material for structural and insulation purposes, a number of deposits have been investigated in the North Pacific region, says the United States Bureau of Mines, Department of Commerce. Apparently a series of separated beds of fresh water origin extends from Quesnel in eastern British Columbia to Terrebonne, Oregon. Deposits are found in southern Idaho, and in eastern Washington, near Wymer, Ellensburg and Vantage Ferry. In western Washington a large portion of the ooze in the bottom of the numerous lakes contains recent diatom skeletons. In many of the old swamps in the glacial drift of the Puget Sound district, diatomaceous earth is found in the black, peaty muck, which when burned leaves a white mass of nearly pure diatomaceous earth. Such deposits are found near Tacoma, Lake Sammamish, Big Lake, on Whitby Island, and near Port Townsend, and undoubtedly will be found in numerous other swamp regions of the Puget Sound district. Not all of this material is loaded with carbonaceous matter. Many of the deposits contain material which when dry is a light gray color.

A cooperative study conducted by the Northwest station of the Bureau of Mines and the University of Washington, Seattle, Wash., shows that material in Kittitas County in eastern Washington occurs above or interbedded with the youngest basalt flows. Much of it has only a few feet of sand and gravel overburden and is in a very soft and loose condition, while other beds have been compressed into a dense and more compact structure by the overlying beds of lava or basalt rock. Some of the whitest diatomaceous earth is to be found near Vantage Ferry. Some of the deposits have volcanic ash impurities which were distributed over the country by the nearby old volcanoes in the Cascade Mountains. The volcanic ash can be distinguished from the diatomaceous earth by its higher specific gravity, its harsh and gritty feel and the absence of diatom skeletons or fragments when studied under a high-powered microscope.

The use of diatomaceous earth in Portland cement to increase the plasticity, to decrease the differential settling of aggregate and to decrease the permeability, has created a new interest in the use of local material in large quantities. The history of past ventures has been a succession of failures of small companies because of the limited market in this district. With this most excellent thermal insulator, found in such large quantities close to the large cities of the North Pacific Coast, there appears to be an excellent opportunity to develop a cheap and easily applied insulation. See article, page 83 of this issue, about the occurrence of this earth in southern California.

Accident Hazards

(*Continued from page* 72)

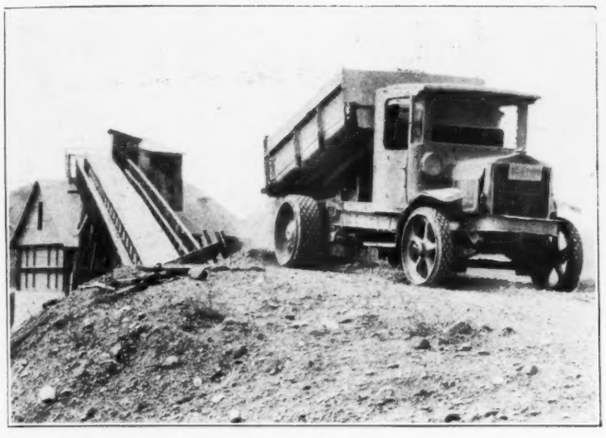
This problem is given national recognition, through the preparation of a safety code for conveyors and conveying machinery, sponsored by the American Society of Mechanical Engineers and the National Bureau of Casualty and Surety Underwriters. Their announced problem is in the interest of "safe operation and maintenance of gravity, belt, chain, flight, bucket, apron, screw and jigging conveyors, car hauls, aerial cableways, overhead trolleys, and pneumatic tubes."

This investigation is being carried on by 28 groups and organizations, including the American Society of Safety Engineers, the American Mining Congress, the Associated General Contractors of America, the National Safety Council, the U. S. Bureau of Standards and the U. S. Dept. of Labor

Albany Trucking Corporation Central Mixing Plant At Capacity in First Year of Operation

Proximity to Both Aggregate Producer and Market a Valuable Asset

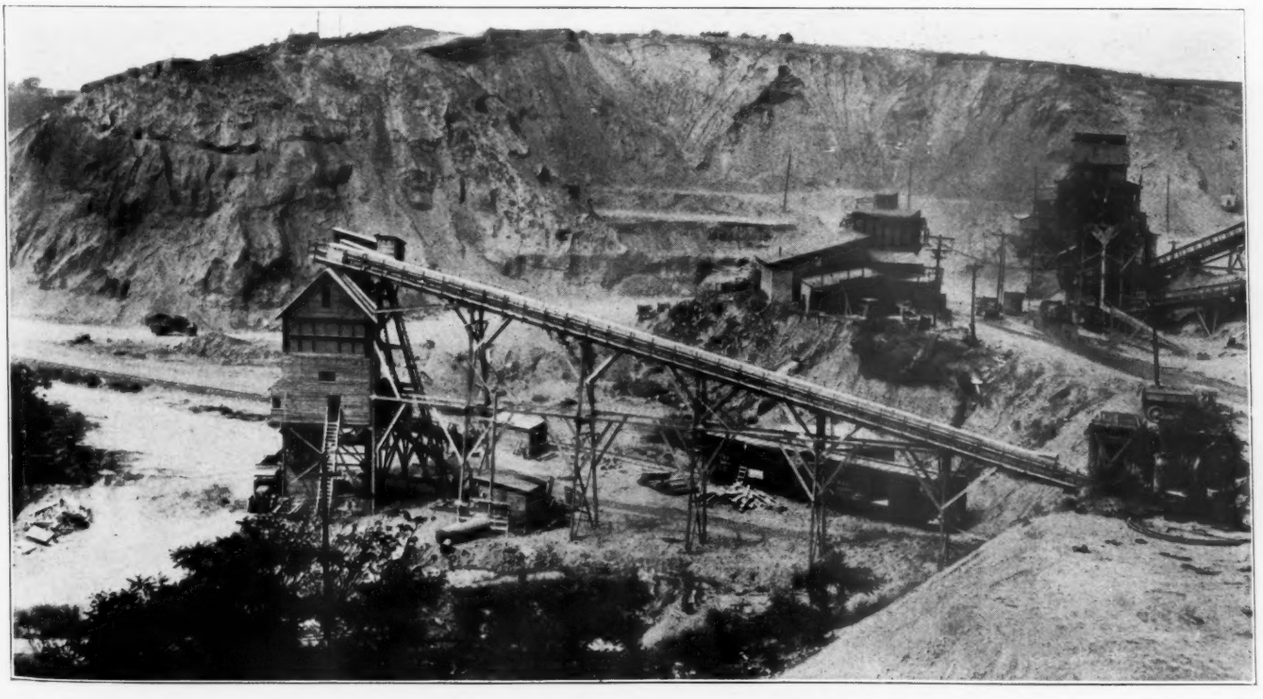
WHEN central mixing plants for the commercial production of ready-mixed concrete first began to create widespread interest some years ago, it was commonly supposed that only the very largest cities could support such a plant. Since that time, however, such plants have been erected and are being operated profitably in cities having populations as small as 60,000. In fact, most of the plants now in operation are in cities of less than 100,000 population.



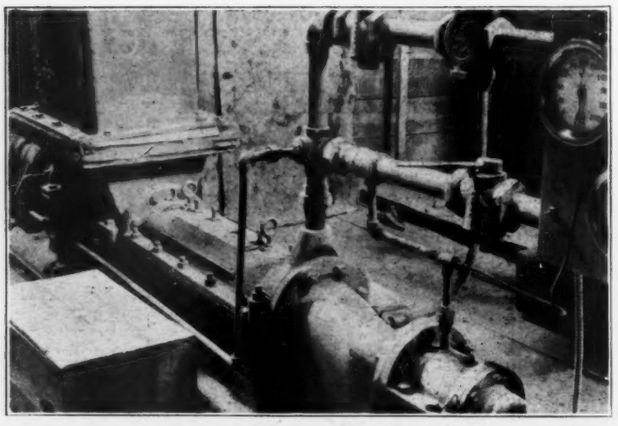
Truck discharging sand and gravel into hopper feeding conveyor to concrete plant

Mixer discharging into one of the agitator trucks

A very good example is the plant of the Albany Trucking Corporation at Albany, New York, a city of slightly over 100,000 population. This plant went into operation in April of this year and has been operating at capacity ever since. It was designed by Frank I. Ginsberg of the H. O. Penn Machinery Company in collaboration with N. D. Crowley, president and general manager of the company. Foundations and runways are of con-



Plant from east showing truck being loaded at left and sand and gravel plant at right with truck discharging to conveyor hopper



The 5-in. pump which keeps plant supplied with cement

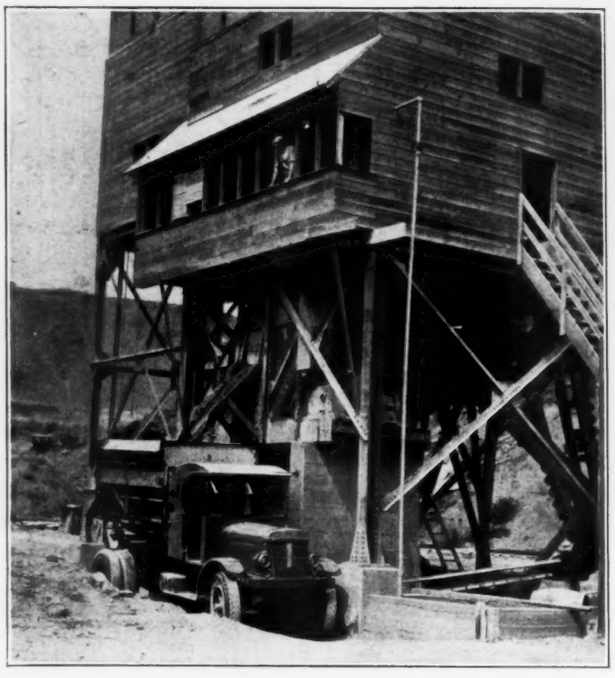
crete and the framework is of structural steel. The plant has a capacity of about 450 yd. of concrete in 8 hours.

The plant is located on Tivoli street at the main line of the New York Central railway, about 2 miles north of the heart of the city. Cement is received on a sidetrack from the railroad and the sand and gravel is purchased from a producing plant less than 100 yd. away. Arrangements are also made to allow the use of crushed stone as aggregate when it is specified.

Sand and gravel from this plant is loaded from the bins direct or from stockpiles by stockpile loaders into trucks. These dump into a 12-yd. capacity wooden hopper from which a Good Roads apron feeder discharges onto a 24-in. 180-ft. centers inclined belt conveyor to the top of the concrete plant. The conveyor discharges through a Butler swivel chute into any one of four compartments in the steel bin structure.

Crushed stone is shipped in by rail from nearby plants and dumped onto a platform under the sidetrack. This feeds through three gates onto a 20-in. inclined belt conveyor which discharges through a chute to a Good Roads belt bucket elevator to the bin. The conveyors were furnished by the Stephens-Adamson Manufacturing Company and Goodrich "Maxecon" conveyor belting

Side view of plant. Sand and gravel conveyor above and crushed stone elevator at right



Another view showing truck being loaded. Operator above does all mixing and batching

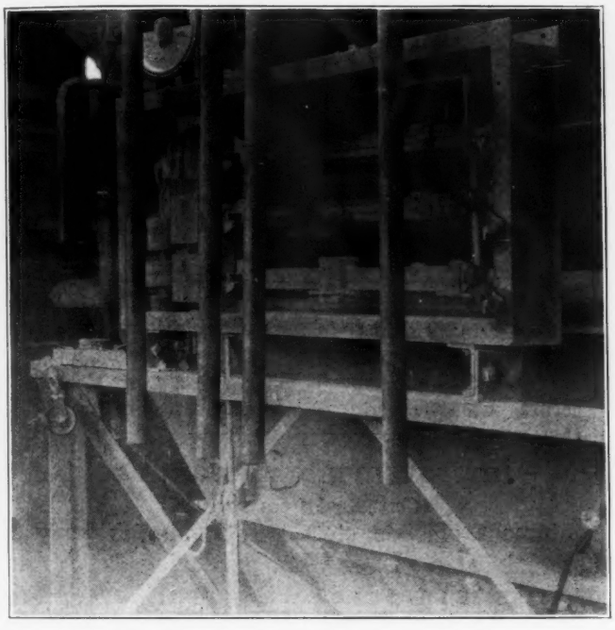
is used. The sand and gravel conveyor and the crushed stone elevator are each belt and gear driven by 20-hp. motors and the crushed stone conveyor by a 10-hp. motor. The aggregate bin has a total capacity of 200 tons and the four compartments are used for 5/16-in. to 1-in. and 1-in. to 2-in. gravel, crushed stone and sand.

The bulk cement is unloaded from box cars on the siding by a Weller power scraper into a hopper feeding the Fuller-Kinyon conveying system. The scraper is operated through a Dodge belt and pulley drive by a 5-hp. Fairbanks-Moore motor. The drive motor is located in a concrete pump house which also contains a 10-in. by 10-in. Sullivan single-stage air compressor furnishing air for the conveying system and the 5-in. Fuller-Kinyon pump. The compressor is belt driven by a 40-hp. motor and the pump by a 30-hp. motor.

The cement is pumped through a 4-in. line to a 120-ton capacity steel cement bin alongside the aggregate bins. This bin has three compartments,

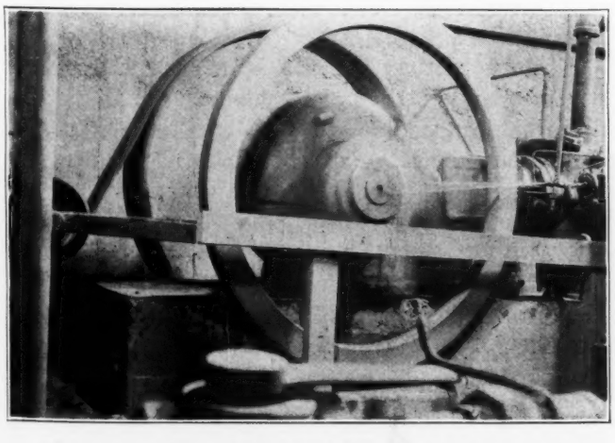
so that different brands of cement can be used to fill the specifications for different jobs. Sliding gates in the bin discharge to a screw conveyor feeding a 60-cu. ft. capacity steel hopper over the weighing batchers. The cement bin is equipped with three levers with projecting rods to keep the cement from sticking in the bin. The screw conveyor is driven by a 2-hp. motor.

The aggregate, whether crushed stone or sand and gravel, discharges into a Blaw-Knox weighing hopper with a three-beam scale and a dial



The sand and gravel weighing hopper with scale and dial above

index registering the last 400 lb. to allow accurate weighing. The cement discharges from the hopper into a similar weighing batcher with a two-beam scale and dial. Water is measured by a Badger water meter into an open-top tank which discharges through a 4-in. line into the Rex 3-yd. mixer. A Koehring batchmeter set at 2 min. 10 sec. trips after all of the batcher gates have been



The compressor which furnishes air for the cement conveying system

One of the agitator trucks discharging a load of concrete on a construction job

tripped, giving a full 2-minute mix. A spotlight shining into the mixer gives the operator a clear view of the mix so that he can add water if the mix is too dry.

All concrete is delivered in C. O. Bartlett and Snow agitator truck bodies mounted on 6-cyl. Autocar chassis with duel pneumatic rear wheels. Each truck has a Heil high-lift hoist which allows the load to be discharged under almost any conditions. The company now owns ten of these trucks. Most of the concrete is used in street and building work. The average haul is about 3½ miles, although concrete has been delivered in good condition as far as 18 miles.

The steel bins and weighing batchers were furnished by Butler Bin Company. All motors not otherwise mentioned are General Electric and starting switches are Allen-Bradley. Crouse-Hinds conduit, Boston Woven Hose and Rubber Company "Bull Dog" drive belts, and "Sprucolite" drive pulleys are used.

A. R. B. A. Manufacturers' Division Opens Washington Office

The American Road Builders' Association, Manufacturers' Division, has opened up an office in connection with the headquarters of the association in the National Press Building, Washington, D. C. William Ogden, who has had many years' experience in the road-building field, especially in the manufacturing field, has been appointed. Mr. Ogden will devote his full time to the work of the division and will be the representative of the highway industries at the headquarters of the American Road Builders' Association. As such, he will develop and carry on, under the supervision of the executive committee, such activities as may be of value to the manufacturers of equipment and materials used in the road-building industry.

Huge Cement-Plant Building Program Undertaken by Russian Government

A chain of cement plants, grain elevators, flour mills, and miscellaneous industrial plants to cost approximately $110,000,000 will be built by the MacDonald Engineering Company of Chicago for the Russian Government. The necessary capital, material, and labor will be furnished by the government, while the plans will be made and the work directed and supervised by a staff of 45 American engineers and steel construction experts.

Robert P. Dunham, president, and John C. Carter, vice-president, of the MacDonald company, agreed, as part of the transaction, to train fifteen Russian engineers in the construction of cement and other industrial plants at the Chicago and New York offices of the engineering company.

The MacDonald company will erect four large cement mills, which will increase Russia's annual cement output from 15,000,000 to 21,000,000 barrels. One of these will be built at Kerch on the Black Sea; another at Spartak, 75 miles from Moscow; a third at Kashira, 130 miles from Moscow; and the fourth at some point east of the Ural Mountains.

The contract, which runs three years, provides that the first plant built shall be equipped entirely with American-made machinery and that, if this proves more efficient than European-made equipment, American machinery will be used throughout the other three plants. The engineering company will be paid on a cost basis plus a fixed fee, periodical payments to be made in dollars through the Chase National Bank of New York. Vice-President Carter will open and take charge of headquarters in Moscow.

On the day after the receipt of this cable dispatch, PIT AND QUARRY received a letter from the Stromstroi State Corporation, inquiring for information about various kinds of equipment for use in cement, brick, tile, refractory, and other building-material plants, which are to be erected in Russia. Whether this has any connection with the subject of the fore-going dispatch does not appear. The Stromstroi Government states that, "Since the information required is for the purpose of designing and estimating," it will appreciate manufacturers supplying, besides their printed matter, "data about overall dimensions, weights, prices and capacity of their machinery," and it explains that whatever orders are placed will be cleared through the Amtorg Trading Corp., 136 Liberty St., New York, N. Y.

The state is interested in the following classes of equipment, and information concerning them should be sent to the Head, Leningrad Division, Stromstroi State Corporation, Krasnaia 9, Leningrad, U. S. S. R.

Agitators
Air compressors
Bag-filling machines
Bags, paper
Belting, conveyor
Bins, clay-tile, concrete, and steel
Boilers, waste-heat
Briquetting machinery
Buckets, aerial carrier, conveyor, and grab
Buildings, portable
Cableways
Car-control systems
Car movers
Car pullers
Chutes and chute linings
Conveyor equipment
Conveyors, pneumatic
Crusher parts
Crushers, disk, gyratory, hammer, jaw, and roll
Derricks
Draglines, cableway
Drill steel
Dryers, sand, and stone
Drill-sharpening machines
Dust-collecting systems
Elevating equipment
Engines, hoisting
Feeders
Fire-alarm systems
Hoists, Fordson
Hydrators
Industrial railways
Kilns, cement and lime
Linings, bag and barrel
Loaders, bin (portable), box-car, and conveyor
Marble and granite making equipment
Mills, ball, rod, and tube
Pulverizers, hammer, ring, and roll
Rolls, crushing
Roofing and siding, iron, steel, and zinc
Rope, wire
Sand-lime brick machinery
Scales, conveyor (automatic), and track
Screening equipment
Screens, perforated-metal, rotary, and vibrating
Separators, air, gypsum, and magnetic
Speed reducers
Stripping equipment, power
Tramways, aerial
Trolley carriers
Unloaders, bin

Improvements in Handbook

(*Continued from page* 60)

equipment, officials, etc.), will enable the reader to ascertain at a glance what producing factors are operating in any section of the country, every plant being separately listed according to its location.

Another new section will provide a directory of *Trade Associations—National, State, Regional, and Local* of interest to producers and manufacturers of non-metallic minerals and their products. This will be the most complete directory of its kind.

Other sections will provide: (1) a list of *Manufacturers' Trade Names* (designed to give the names and addresses of the makers of equipment when only the trade names are known); (2) an *Equipment Catalogue Index and Buyers' Guide* (which will give an index to equipment makers' catalogue pages classified according to product); and (3) an alphabetical *Index to Advertisers.*

Former editions of the HANDBOOK have been given unqualified endorsement by non-metallic mineral producers everywhere, and impartial critics have been lavish in their praise of its many good qualities, as witness the latest evidence of appreciation reprinted on page 32 of this issue of PIT AND QUARRY. The many improvements to be embodied in the 1930 edition will make the new HANDBOOK deserving of even higher praise than has been given its predecessors. Judged by every standard—completeness, accuracy, authority, lucidity of style, and form of presentation—the HANDBOOK has won a secure position among the recognized trade and engineering handbooks.

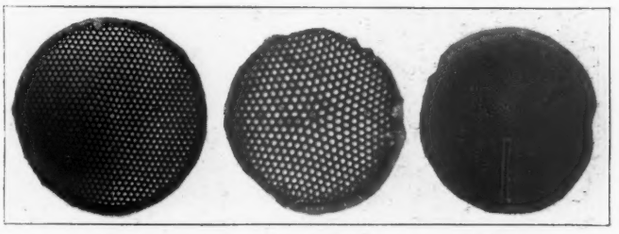
Floatstone Company Prepares Industrial Products From Diatomaceous Earth

By GORDON F. SONDRAKER

DIATOMACEOUS earth is one of the most important of the industrial earths. This material receives its name from the organisms known as diatoms, whose siliceous skeletal remains, countless in number, make up this earth. It is an interesting fact that diatoms exist today in both the salt and fresh waters of the earth. The diatomaceous earth deposits now being operated were formed millions of years ago from remains of diatomaceae, some few genera of which have remained unchanged in structure.

Diatoms are algae of microscopic size and single-cell structure, the cell walls being of silica. Each cell, known scientifically as a frustule, comprises halves, known as valves. The German name for the resulting earthy material is Kieselguhr. In this country a common name for it formerly was infusorial earth.

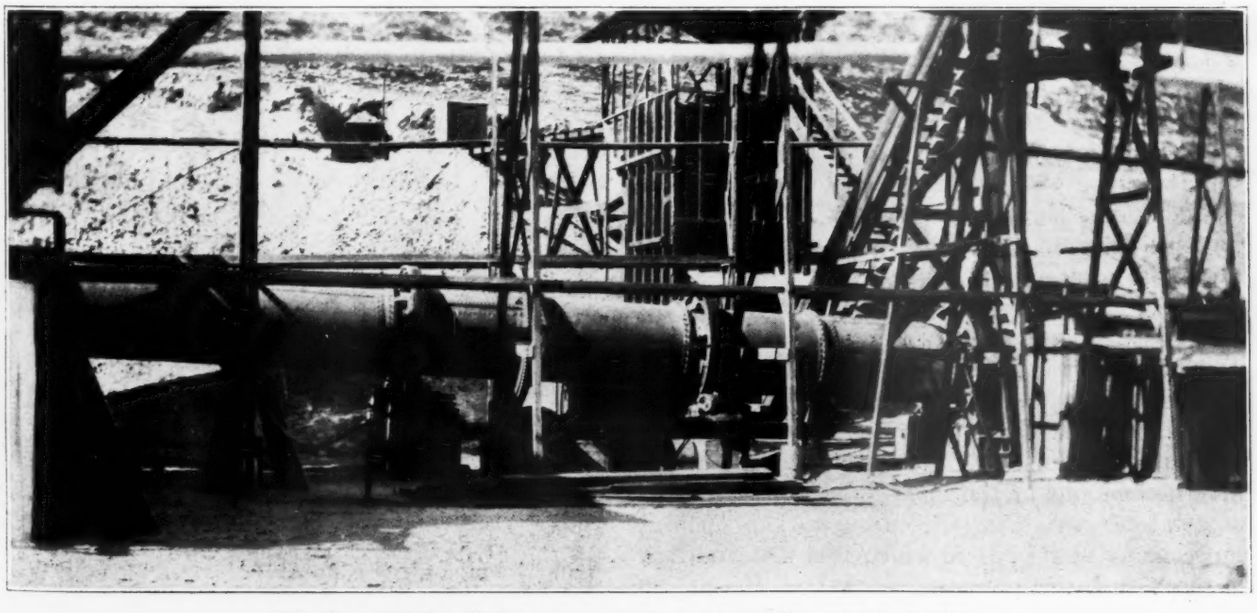
During the course of extensive research work by E. S. Hastings, consulting engineer of Los Angeles, Calif., living diatoms were secured from the Los Angeles river and photographed under a high-power microscope. It was exceedingly difficult to take clear photographs of the minute organisms because of their movements. This was accomplished, however, by a chromic acid bath and the diatoms were photographed. It was found that their skeletons were identical in structure with certain of the classified diatoms of prehistoric ages. When one considers the evolution of almost all other living things, the subject proves more amazing when we compare these living diatoms with their ancestors of millions of years ago.



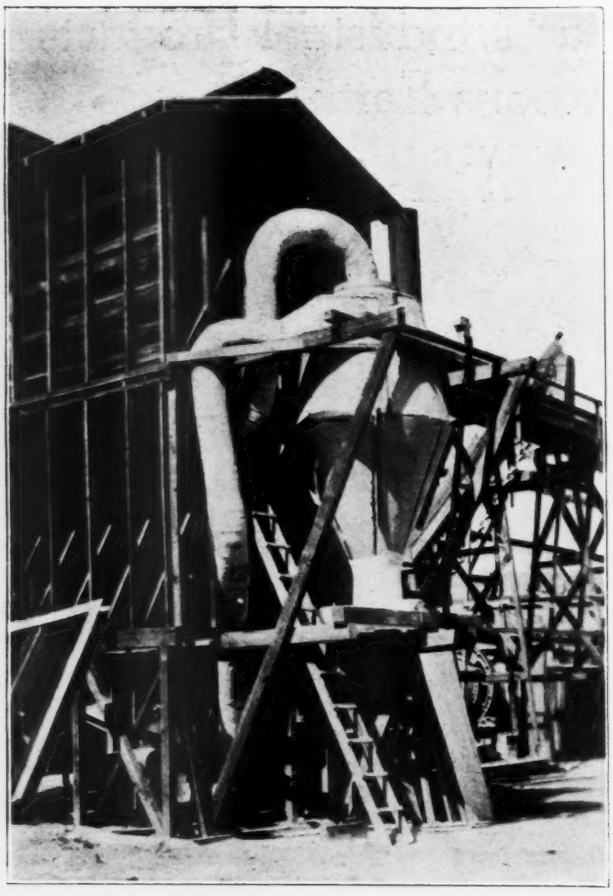
Diatoms highly magnified. Left to right: Cascinadiscus Lineatus, Excentricus, Cascinadiscus subtiles

The diatomic skeletons vary in form in practically every deposit and it is not unusual to find hundreds of different types of diatoms in the different strata of the same deposit. These diatomic skeletons run so true to type in their physical structure that the better known deposits can be identified by microscopic examination. This unique uniformity is demonstrated by the identification of the same species of diatoms from deposits all over the world. Mr. Hastings is authority for the statement that 8,000 species have been classified, and that some 7,000 additional species are being investigated.

Diatomaceous earth differs from other non-metallic minerals in that its chief value for industrial purposes lies in its physical structure rather than its chemical composition. High-grade diatomaceous earth should contain about 92 per cent silica and 8 per cent water of crystallization when thoroughly air-dried. However, such a degree of purity is rarely found in commercial deposits and



Kiln for calcining diatomaceous earth, crude ore bin, portal of mine



Bag-house and cyclone

the material at present marketed has a chemical analysis approximately as follows:

	Per Cent
Silica	85
Iron and aluminum oxides	2
Lime and magnesia	3
Potassium and sodium oxides	1
Water and organic matter	9

In many of the commercial uses of this material the impurities are of little consequence so long as they are within reasonable limits. When used as a heat insulating material, the allowable limit of foreign matter that might act as a flux would be governed by the temperatures to be withstood. For use in filtering, the nature of the liquid to be filtered will be the governing factor. One large operator has devised treatments for the crude material that, in a measure, fits it for particular filtration needs. In general, however, it may be said that most diatomaceous earths which are fairly free from impurities and that contain diatomaceae of proper physical structure are successful as filtering mediums.

Diatomaceous earth is so readily adaptable to such a large number of uses that, eventually, it may become one of the most important of the industrial non-metallics. Research work is opening up so many new fields in which this material may be used that the potential market is almost unlimited.

During the past few years the use of this earth in concrete has grown to such an extent that it may be classed as one of the major markets for the material. Due to the peculiar cellular structure of the material and its specific gravity of about 2.07, it forms an almost ideal admixture, filling the minute voids in the aggregate and accelerating the concrete's flow in the forms.

The largest and purest known deposits, as well as the most important from an economic commercial standpoint, are located along the coast in southern California. Until recently one major operator mined 90 per cent of all the diatomaceous earth marketed from these deposits. Recently, however, a number of smaller operators, attracted by the tremendous market possibilities for this material, have erected mills on several of the deposits and are marketing their product both locally and in the eastern industrial areas.

Floatstone Company's Operations

The Floatstone Company owns a deposit approximating four million tons of high-grade earth whose predominating diatomic structures are technically classed as Cascinadiscus and Synedra. In the photographs the Cascinadiscus is represented by the small rounded discs having hexagonal cells. The Synedra class is represented by the wire-like particles accompanying the Cascinadiscus.

The company's deposit and plant are located in

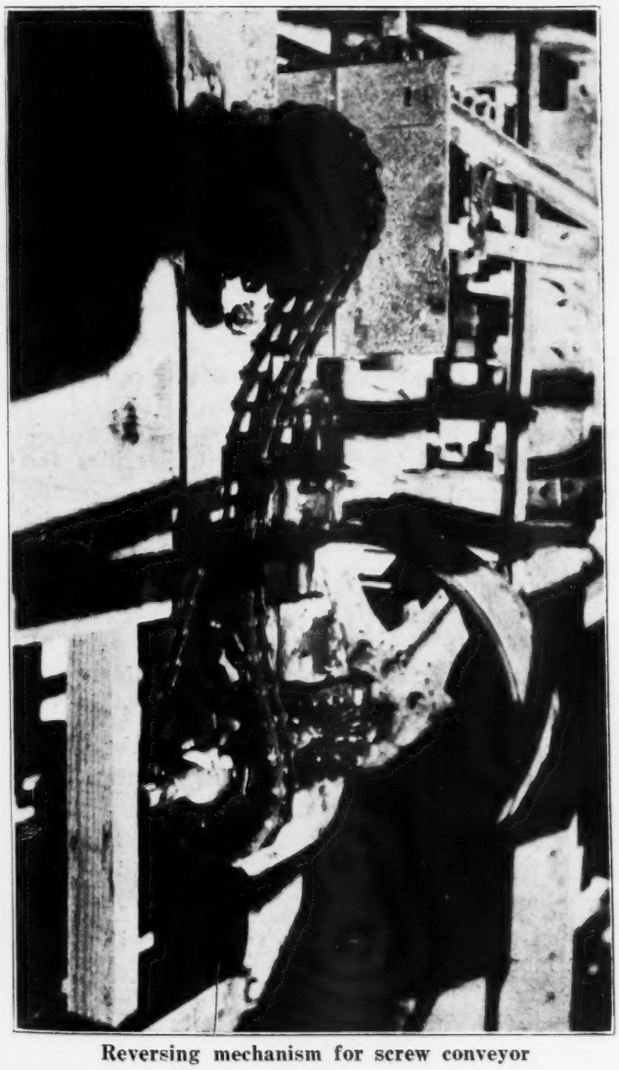
Fan that supplies heated air to fine-grinding mill

the Palo Verde hills, approximately six miles from Wilmington, the marine shipping point for Los Angeles, and are at a strategic point for truck shipments to the principal local markets.

At present the crude earth is mined from a main working tunnel measuring 8 ft. by 8 ft. and extending into the hill for about 300 ft. Six drifts at 100-ft. intervals extend from both sides of the main tunnel, thus furnishing seven working faces. It is planned to extend this tunnel through the hill, a distance of some 2,000 ft., and to open up new drifts at desirable intervals. By this system the deposits will ultimately be honeycombed with drifts. If, years hence, it is found desirable, stoping operations can be practiced to recover the material that extends some 300 ft. above the level of the present working tunnel.

Milling Practice

As mined, the material is soft; in fact, so soft that, with ordinary effort, one may drive a pick several inches into it. The present method of mining is manual, by pick and shovel, from the drift face to ¾-cu. yd. swivel, end-dump cars. Narrow-gauge tracks are laid in the main working tunnel and the drifts. The track from the head of the working tunnel to the crude-ore bin is laid on a gentle down-grade to allow hand-tramming of the loaded ore-cars.

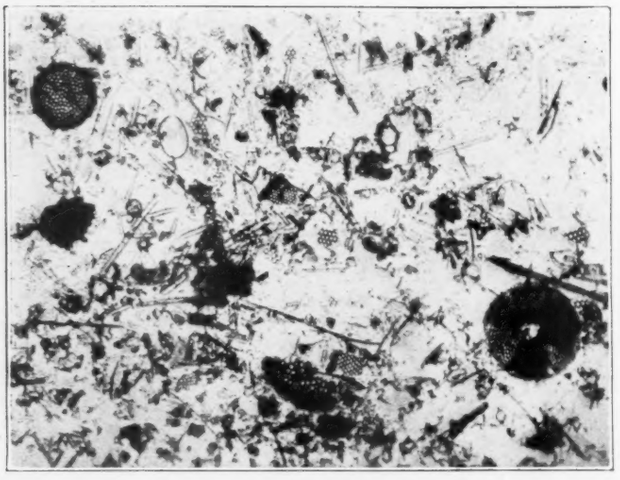


Reversing mechanism for screw conveyor

Fine-grinding mill, with hot-air and exhaust pipes

The cars are pushed to a 40-ton-capacity wooden bin, which serves both for storage and as a feed bin to the rolls. From this bin the material is drawn through gates onto a feed belt 14 in. in width by 6 ft. in length. This feed belt provides a steady flow of the crude earth to two sets of spike-tooth rolls which reduce the material to ½ in. and finer. The rolls and feed belt are driven jointly by a 15-h.p. General Electric motor.

The earth drops from the spike rolls to a McKain elevator having buckets that measure 8 in. by 7 in. by 5 in. These buckets are fastened to a canvas belt 40 ft. in length and the assembly is driven by a 3-h.p. General Electric motor. The material is elevated and discharged onto a 14-in. belt conveyor 94 ft. in length. This conveyor is so designed that it is reversible at will, conveying the rolled product either to the tube-mill for grind-



Diatomaceous earth after calcination

ing or to the calcining plant, these units being located at opposite ends of the conveyor. Another 3-h.p. General Electric motor furnishes power for the conveyor.

The Floatstone Company is producing two principal products: one, for use as a concrete admixture, and the other, for filtering purposes. Inasmuch as different treatments are necessary, we will describe each unit separately.

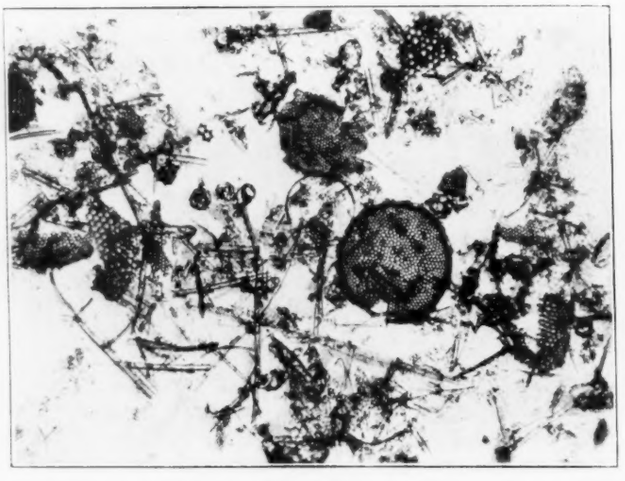
Admixture Plant

The material falls from the belt conveyor into a steel tank having a capacity of 25 tons. It is drawn from this tank through a steel gate into a McKain screw conveyor 9 in. in diameter by 12 ft. in length, which discharges into a scoop-feeder especially designed and manufactured for this installation by the Anderson Blow Pipe Company. This scoop feeds the earth into a 4-ft. by 8-ft. Federal Tank and Steel Company's tube-mill that is lined with silex and that uses flint pebbles as the grinding medium.

Of especial interest is the method of treating the material at this point. As stated, crude diatomaceous earth contains 25 to 40 per cent moisture when mined. Obviously one could not expect to achieve much success in grinding the material while in this moist condition because of the coating that forms on the grinding pebbles and minimizes their grinding effect. Gas is fired in a furnace and the resultant hot air and gases of combustion are blown by a fan into the feed opening of the mill at a temperature of approximately 900 deg. F. Usually tube-mills are supported by water-cooled bearings at both ends, the bearings being lined with babbit metal. In this case, to preclude the possibility of bearing trouble caused by heat, the mill is supported at each end by two steel trunnion rolls similar to those of rotary cement kilns. While this mill has been in use only a comparatively short time, it gives promise of success for the purpose of its design.

Gas-fired furnace to produce hot air

Two Federal Tank and Steel air classifiers take the ground, dried diatomaceous earth from the mill and classify it. The first classifier removes all oversized material and returns it to the mill for regrinding. The second unit classifies the material into two sizes—minus 200-mesh and minus 350-mesh. From this classifier the material is blown to the bag-house, whence it is sacked through spouts, and is loaded onto trucks for shipment or is stored.



Floatstone Company's earth before being calcined

Calcining Plant Prepares Filter Material

The calcining plant was designed and erected in such a manner that the material may be either ground and dried, or calcined. The material falls from the reversible belt conveyor mentioned above into a wooden bin having a capacity of 25 tons. It falls from this bin through a chute to a Williams hammer mill. This mill is driven from a line-shaft which is driven by a 30-h.p. Westinghouse motor.

Hot air is generated in a gas-fired furnace and is mixed with the material at this point. The Wil-

(*Continued on page* 94)

Opponents of Metric System Present Their Case

A CERTAIN old saying applies to the majority of topics with which the average practical man is concerned intimately. That there are two sides to the matter of changing our American system of weights and measures has long been known. We pride ourselves upon the obvious advantages that our monetary system has over the corresponding systems of nearly all the other nations, but we cannot claim such superiority over a number of other nations in the matter of convenient units for measurements and weights.

The metric system was devised years ago by scientists. Its use in scientific and many laboratory lines is prevalent in our country, but we have not decided unanimously that the adoption of the system would be advantageous in our industries. Occasionally a decided effort is made to have national legislation establish the metric system as our standard, and there is a prospect that what is known as the Britten resolution may be introduced in Congress this winter.

That the resolution will not pass without radical opposition is assured, for there is a substantial group of influential men who compose the American Institute of Weights and Measures with the avowed purpose of maintaining our present system. A recent circular letter over the signature of its secretary, Wm. E. Bullock, is intended to inform the public, especially manufacturers, about the disadvantages that would ensue if the resolution were to prevail. This letter is a fair discussion of the whole subject, and we quote what follows from it, with the caution that the statements are not to be construed as editorial opinion but to induce thought on both sides of this question.

The arguments commonly given in favor of the metric system itself are:

1. Compared with the metric system, the English system is antiquated and cumbersome.
2. The metric system is consistent and easy, having only three fundamental units related to each other.
3. The English system involves great waste of time, and the use of fractions unwieldy.
4. The metric system gives great ease of operation, since many operations require only the moving of the decimal point.
5. The metric system is on the way to becoming an international system.
6. If the United States adopts the metric system, the British Empire will follow suit.
7. The English system can never become universal, for it is inconceivable that the countries now metric will change.
8. The world needs an international system of weights and measures, just as it has a universal system of numerals.
9. The metric system is scientific, invariable, precise and exact, and is in almost exclusive use in scientific work.
10. The advantages of the decimal system are shown in our currency system.
11. The benefits to be derived from the metric system would soon justify its adoption, and the temporary inconvenience in making the change is better than the constant inconvenience of our present system.
12. The metric system could be introduced in such a way as to minimize confusion and loss.
13. The change to the metric system could be made without abandoning existing plants, machines and apparatus.
14. The cost of the change to the metric system would not be prohibitive.
15. That there is a persistence of old units and an incomplete use of the metric system in some other countries, is no valid argument against its further extension in this country.

In a pointed article in the "Nation's Business" for October, Senator Reed Smoot, of Utah, calls attention to the astounding growth of the Federal executive machine in Washington in recent years. He decries the situation because he considers the growth has been largely "amorphous." By this he probably means non-crystallized—that is, without intelligent direction or purpose. In fact, he says:

New Fields, New Bureaus

"Laws have been enacted by the score to put the Government into new fields of activities. For present purposes, at least, let it be assumed that all of the motives involved have been entirely worthy and that all of the new fields of activity have been quite proper for the Federal Government.

"The point is that each new law of this character almost inevitably brings into existence a new executive agency to administer its provisions.

"Even when the task is entrusted to one of the existing departments or bureaus, it means that that department or bureau must create, within itself, a new bureau, or division, or section to do the new work.

"When Congress enacts a law of this character, it does not, of course, make a complete survey of the existing executive machinery to determine just where the new responsibility should be placed. Such a survey is a long and tedious process, as was demonstrated amply by the experience of the Joint Committee on the Reorganization of the Administrative Branch of the Government a few years ago. Hence, the tendency is to assign the new work to the first convenient agency that suggests itself or —and this happens with increasing frequency—to propose the establishment of a new executive agency.

"The latter tendency is the one that deserves most serious consideration. It is a serious matter because history has demonstrated that agencies of government, once created, tend to perpetuate themselves indefinitely. Moreover, they grow and con-

stantly demand authorization from Congress for increased personnel and more liberal appropriations.

"If a government department or bureau should ever report to Congress that its jurisdiction should be curtailed or that it had fulfilled the purpose for which it was created and should be abolished, undoubtedly there would be a demand for an investigation to ascertain what was wrong.

"It has often been said, facetiously but not altogether falsely, that as soon as a man is placed at the head of a new bureau and directed to do a specific piece of work he immediately begins to devote about half of his time and energy to thinking up projects which can provide work for his organization after the original project is completed. This is not an aspersion on the patriotism or good faith of bureau chiefs; it is merely a statement in recognition of one of the fundamentals of human nature."

Among the September and October newspaper clippings is a good sprinkling from all over the country of the following editorial. The source is recognizable:

"Efforts are to be renewed during congressional session to secure the enactment of legislation establishing the metric system of measurements. How successful the movement will prove remains to be seen. A similar campaign nearly a quarter of a century ago won the support of the Bureau of Standards at Washington, but was unable to overcome the opposition of manufacturers, who complained that compulsory change to the new system would involve expense and create untold confusion.

"With the exception of the United States and the British Empire, the metric system of weights and measures is virtually universal among commercial nations as the official system. But in many of those countries where it is the official system some other method is in popular use. In several South American countries the metric system is recognized as standard but the people measure by the old Spanish and Portuguese systems. Even in the United States there are vestiges of other systems, as in Louisiana, where land is sometimes measured by the 'arpent' instead of the acre, and in Texas, where the Spanish 'vara' is not uncommon."

The following paragraphs from the report of a production adviser to his vice-president, who asked him to comment on the proposed change to the metric system of weights and measures, are of interest:

"The expense will start in the engineering department. All tracings will have to be retraced with English dimensions converted to metric dimensions. It is roughly estimated that, to change over the tracings in active circulation only would require the combined effort of all employees in our engineering departments working on nothing else for one year to make the change. New tracings with new numbers will mean a complete new set of specifications. It is no criticism of our engineering talent to say that some errors in calculation of dimensions would no doubt be made, which errors will go through to the machine shop, resulting in incorrect machining and a consequent increase in assembly cost.

"In the factory, one of the smaller items of expense will be in changing all precision instruments. Scales and micrometers with metric graduations will have to be purchased both by the company and the employees.

"The prohibitive item of expense is in machine tools. Practically all machine tools will have to be rebuilt. No lead screws or gearing now on lathes can be used for cutting metric threads. There will have to be a change to metric lead screws and metric gears. Feed mechanism and gearing in milling machines, grinders, etc., should be changed. Tapping attachments on radial and upright drills would have to be revised to cut metric threads. All dial indicators used on any type of machine would have to be replaced with indicators with metric graduations. The entire stock of drills, taps, reamers, etc., would have to be replaced with metric tools."

This report concludes that the company should support any reputable organization making a real effort to block the proposed change to the metric system of weights and measures.

Here we end the quotations from the letter issued by the American Institute of Weights and Measures. On the staff of each plant in the nonmetallic industries there are probably men who hold opposing opinions in this discussion. The above arguments will provide them good material for friendly debate.

Cement Association in Session

As we go to press the Portland Cement Association is holding its formal annual meeting at the Blackstone Hotel, Chicago, attended by members only. Officers are to be elected for the ensuing year, and the results will be published in our next issue.

Kind Words

A reader finished a recent letter in which he renewed his subscription to PIT AND QUARRY with the comment, "Needless to say, your magazine cannot well be excelled."

Mining and Washing Practices in the Hard-Rock Phosphate District of Florida

By J. R. CUDWORTH

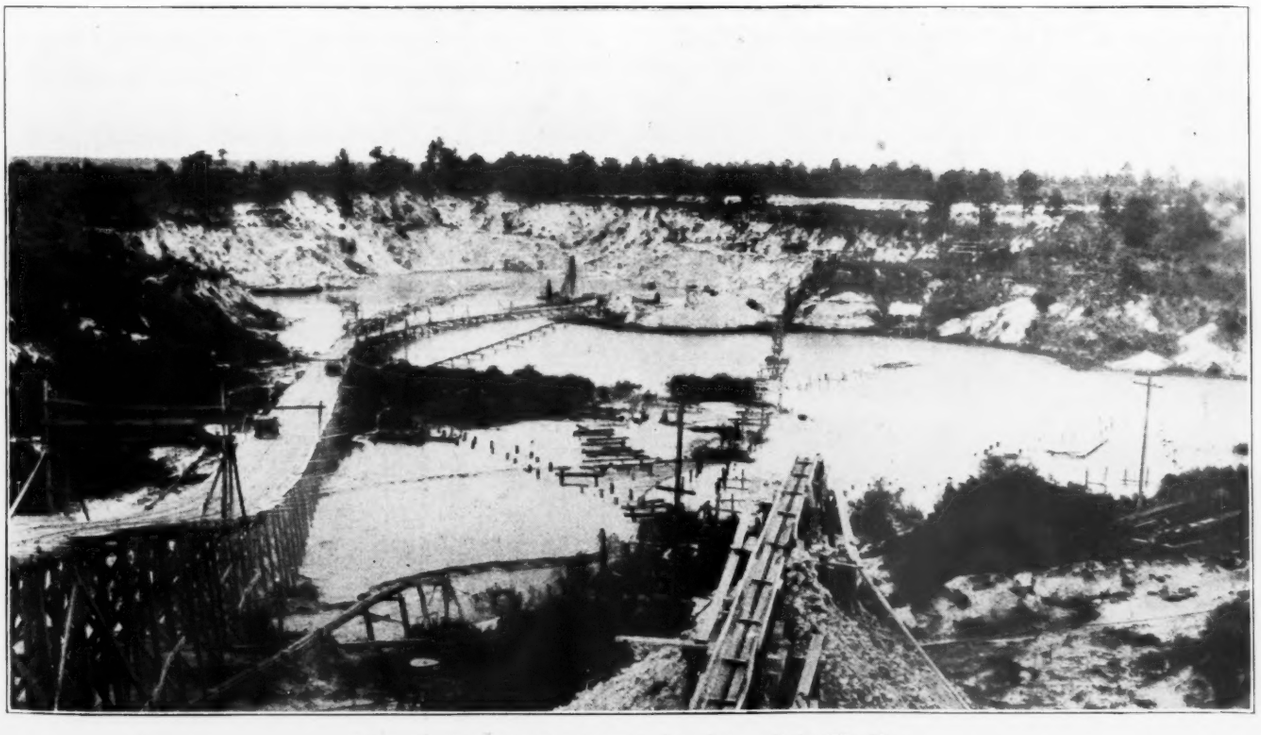
THE hard-rock phosphate district of Florida, although smaller in production than the land-pebble phosphate district, covers more territory. It extends over an irregular-shaped area southward from Columbia and Sewanee Counties in the north to Pasco County, including parts of Alachua, Marion, Levy, Taylor, Citrus, and Hernando Counties. Present operations are largely confined to the last two mentioned counties, although another plant, that of the Owl Creek Phosphate Company, is under construction in Taylor County. The production of hard-rock phosphate in 1927 was 131,254 long tons.

Hard-rock phosphate mining has been carried on since 1889, which was shortly after the deposits were discovered. Production has, however, fluctuated between periods of great activity and depression. At one time there were over forty plants in operation in the district, but that number has steadily decreased until, at present, only two or three plants are reported in operation.

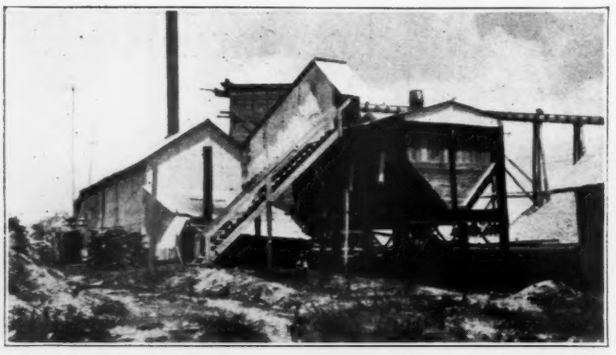
The hard-rock phosphate deposits differ in character from the better known land-pebble deposits which are worked on a much larger scale. The hard-rock phosphate formation varies widely in thickness, depth from the surface, and in composition. Its predominating phase is a phosphatic gray sand matrix, which is easily broken up, and which contains the desired lump-rock phosphate together with more or less soft phosphate, flint boulders, limestone boulders, clay, and other materials. The overburden is predominantly sand.

Pit of C. & J. Camp Company near Felicia

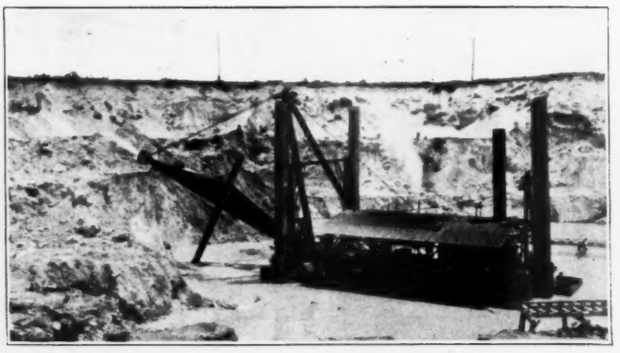
Because the phosphate formation is so varying in its phosphatic content and its physical characteristics, it requires extensive prospecting. Hand augers and well drills are used for this work, and it is common practice to drill at 50-ft. intervals where the ore changes rapidly. Information is obtained from the drilling as to the depth of overburden, thickness of the phosphate matrix, and the phosphatic content. The overburden averages



General view of a hard-rock phosphate pit in Florida



Drying plant of C. & J. Camp Company



Dredging phosphate rock near Felicia

about 30 ft. thick at two of the operations visited.

In the older and smaller pits, the overburden was removed by picks and shovels, horse scrapers, and steam shovels. These have now been replaced by hydraulicking methods. To remove the phosphate matrix, it was formerly the practice to use dry mining methods wherever the nature of the country permitted, but, in the present operations, dry mining has been replaced by dredging. The steam dredges are constructed locally, most of the machinery being supplied by the Tampa Shipbuilding Company of Tampa, Fla. These dredges are wood-fired and similar in construction, although they vary somewhat in capacity. They are of the dipper type with dippers of 1½ to 1¾ cu. in. capacity. The dredges are capable of reaching a depth of 37 ft. below water level with about a 50-ft. boom. In some cases, due to seepage, difficulty is experienced in maintaining sufficient water in the pits.

The phosphate matrix is dumped by the dredges into 1½-cu. yd to 1¾-cu. yd. cars, which are hauled by steel cables up inclined wooden trestles to the tops of the washeries. These trestles are extended into the pits as the dredges advance. The empty cars return down the trestle by gravity. In the larger pits, sometimes, two dredges are employed. On the trestle each haulage way is double-tracked, which allows the cars to be hoisted independently. The pits vary in size, depending upon the state of development.

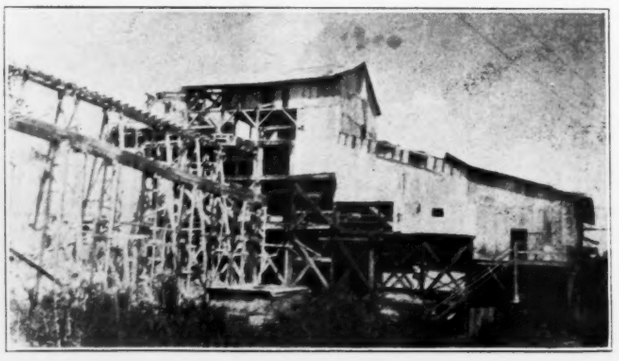
The washeries are of frame construction covered with galvanized iron. They are designed to secure gravity flow of the feed so as to eliminate sand pumps as far as possible. The washing practice is similar at all plants in the district, and no attempt is made to recover soft phosphate ore of the finer sizes. In this respect, the washing practice differs from that in the land-pebble district.

The material to be washed, in this district, as already mentioned, consists of pebbles or boulders of phosphate embedded in a matrix of sand and clay. Some of the boulders require blasting before feeding to the crusher. Much of the coarse debris can be separated before crushing. The following flowsheet of the C. & J. Camp Company's washery at Felicia, south of Dunnellon, exemplifies the practice in the district and is the most recently installed washery now in operation in the district.

The Felicia Plant

The ore from the pit is dumped onto a grizzly, of local design. The size of opening can be varied by electrical control, which allows large pieces of waste and clay to be removed. On the grizzly, partial disintegration of the ore is obtained by water from a high-pressure, manually-controlled nozzle. After the separation of large-sized waste and rock, the latter, which is the oversize of the grizzly, passes into a 36-in. by 60-in. Allis-Chalmers, Fairmount type, crusher, which is driven by a 100-hp. General Electric induction-type motor. The crushed ore then joins the grizzly undersize and passes to a cone screen, 3 ft. in diameter at the intake and 5 ft. at the discharge, with 3-in. openings. From this screen, the oversize passes to a small, round,

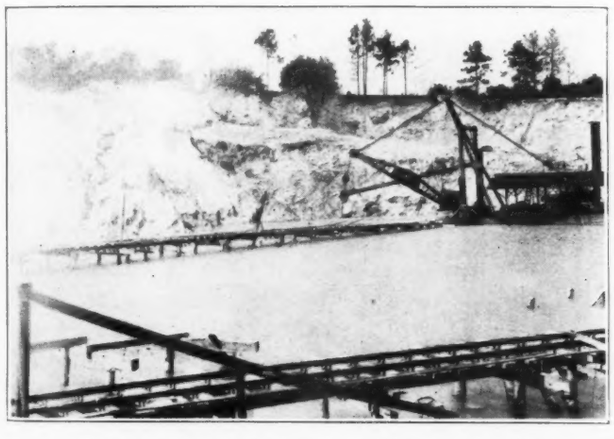
Blue Run pit as viewed from top of washery



J. Buttgenbach Company's washery

picking table, where pieces of waste are hand-picked and discarded. The phosphate rock from the picking table passes into a single-roll crusher and joins the undersize of the cone screen, which is fed into a home-made log washer about 30 ft. long. The overflow from the log washer passes out to the debris dump, while the sand product goes to a home-made double-jacketed trommel, 4 ft. in diameter, with slotted openings 1-in. by 1½-in. on the inner jacket and 1-in. by 3/64-in. on the outer jacket. The undersize product of the outer jacket is largely fine sand and clay which is discarded, and the oversize of the outer jacket (plus 3/64-in.) passes to a hopper. The coarse product from the inner jacket passes to a home-made revolving picking table, 16 ft. in diameter, with a 2-ft. belt leaf.

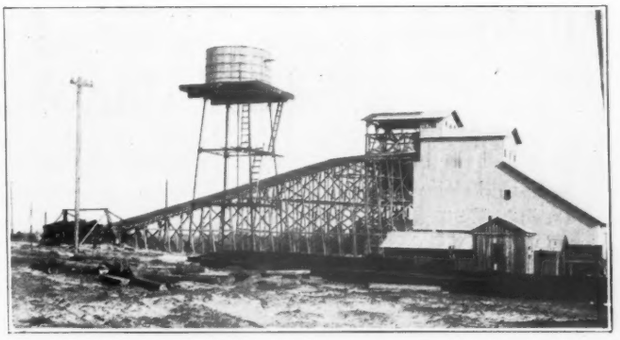
From the materials on the picking table, negro laborers remove and discard pieces of waste and fine rock. Then the clean lump ore drops from the table into a hopper, below which it joins the fine oversize product of the trommel. From the hopper an elevating belt conveys the phosphate to a storage bin, from which it is distributed to reserve storage piles, according to its phosphate content.



Dredging in J. Buttgenbach Company's pit

The maximum capacity of this plant is about 250 tons of finished product per day, but the tonnage handled varies with the grade of ore mined. Phosphate rock produced by this company either is shipped as wet ore or is dried locally.

The drying plant of this company is the only one in the district in operation at present. To be sold as dry ore the market requires that the moisture content must be kept below three per cent. At Felicia, the wet ore from the storage bin is conveyed by a Goodyear traveling belt to an Allis-Chalmers crusher, where it is reduced and fed by a bucket conveyor into a 3-ft. by 30-ft. oil-fired rotary dryer. From the discharge end of the dryer, the ore falls into a hopper of a bucket elevator, which raises it to a second hopper with a chute to the railroad cars. Steel cars with closed tops and bottom dumps are used for transporting the dried ore.



C. & J. Camp Company's washery, showing incline

Blue Run Washery

The Blue Run washery of the J. Buttgenbach Company at Dunnellon is of similar construction and operation, although differing in the types of crushers and other equipment used. Phosphate rock produced by this company is shipped as wet rock to Fernandina, Fla., where it is dried and exported. The J. Buttgenbach Company is developing another plant at Hernando.

The hand-rock ore that is produced is shipped by the Seaboard Air Line and the Atlantic Coast Line railroads, for both export and domestic trade. The J. Buttgenbach Company, which is a Belgian concern, exports all of its product from Fernandina, as mentioned. The grade of the ore shipped from the district varies from 76 to 82 per cent bone phosphate of lime. The highest grade contains only 1.5 per cent iron and alumina.

The writer acknowledges the assistance of the officials of the companies now in operation and of the Florida Geological Survey. D. B. Kilber, Jr., is general manager and H. W. Rives is general superintendent, of the J. Buttgenbach Company with headquarters at Dunnellon. The officials of the C. & J. Camp Company are: C. & J. Camp, president and vice-president respectively; J. T. Rawls, general manager; and E. V. Rayburn, superintendent. The headquarters of this company are at Ocala, Fla.

Washery of C. & J. Camp Company's washery, and storage piles of phosphate rock

Feldspar Has Attained Prominence in Numerous Modern Manufacturing Industries*

WHILE variously termed feldspar, feltspar and felspar, the name feldspar is a general term in mineralogy for an important rock-forming group of minerals. The feldspars are all anhydrous silicates of alumina, containing either potash, soda or lime alone, or two of these bases together. In the form commonly known as spar rock, which is of igneous origin, it appears in pegmatite formations of crystalline rock masses in company with quartz, mica and other minerals, the principal deposits on this continent being located in North Carolina, New Hampshire, Maine, Connecticut, New York, Maryland, and Eastern Canada. Spar rock is procured from deposits, some of which are near the surface, others extending deep into the earth. These deposits vary both as to size and quality, the quality being determined by the chemical make-up of the rock and by the quantity and nature of the foreign substances present.

There are today so many uses for feldspar, that to list the articles in which it is used would require a book of great volume. From scouring soap to the costliest articles of delicate beauty, from the bath tub to the most minute parts of the radio. Artificial teeth, high-voltage electrical insulators and even some semi-precious stones such as the moonstone and the amazon, all contain the mineral feldspar. As a more prosaic and direct explanation of its many uses, it can be said that feldspar is indispensable in the manufacture of sanitary, electrical, chemical and medical articles as well as a great number of glass products. Feldspar is, indeed, the jack-of-all-trades in the mineral family.

Porcelain is a ceramic ware, in many varieties, and is divided into classes in accordance with its composition and the method of its manufacture. It is dependent for its distinctive character upon the grade of materials used and the quality and quantity of the more fusible feldspar which is added to these materials. Without going too deeply into the technical study, it can be generally said that the prime difference between porcelain and pottery is the difference in the degree of temperature at which the two products vitrify, the porcelain requiring the high temperature of between 1,300 deg. and 1,400 deg. C.

The average person would scarcely believe the variety of uses to which porcelain is put. You turn a porcelain faucet for your morning toilet, your breakfast is prepared with the aid of porcelain, you ride to your office through the functioning of your car's spark plugs. Possibly the electrical current for your factory in Alabama was brought to you through high powered lines from Canada which would not be possible were it not for the high tension porcelain insulator. Throughout the industries of the world, feldspar, by its strength-giving and insulating properties, plays the important part of making possible this extensive use of porcelain. Porcelain of superior quality is now produced in America.

The term "tile" has, through incorrect usage, come to have several different meanings. There are those people who would think of tile as being any form of slab which is flat and one of many pieces covering a flat area. The correct, and most common meaning of the term, however, is confined strictly to the various ceramic products used for both building and engineering construction. For the most part, tile has a hard, vitreous surface. It is used mostly where ornamental and sanitary conditions are desired. Exception to the vitreous facing are tiles made for architectural use. These, however, should often be listed under the classification of terra cotta rather than tile.

The use of tile dates from very ancient times since roofing tiles date back several centuries before our era. These were first made by the Chinese and were used by them for covering their buildings. Records show that the Greeks also made this form of ware and the Romans imitated the Greeks. The shapes used by these nations are wrongly called Roman tiles, as this same pattern was first used by the nations of the Far East. At the United States Pottery, Bennington, Vt., experiments were made with inlaid tiles in 1853 and a sufficient number were made to cover a floor space of seven square feet. Since these days of early experimentation, there have been all kinds and shapes of tile manufactured for an innumerable number of uses. The various classes of tile can, however, be listed fairly well under roof tile, wall tile, floor tile and refractory tile. Their uses are in the most part as their name indicates.

The important part which tile plays in our modern life was well expressed by the eminent physician and health advocator who said the progress of a nation is dependent on that nation's health. If such is the case, it can be equally well taken that the health of a nation is dependent on that nation's sanitary conditions, of which tile is a very prominent exponent. Here again feldspar claims its paramount importance through the fact that it constitutes from 50 to 60 per cent of the raw material tile contains.

* Excerpts from circular issued by Feldspar Grinders' Institute, Inc.

Terra cotta might well be nicknamed the Beau Brummel of the brick family. It differs from brick in its high quality uniformity and hardness, and is produced in various colors. The earliest use of the forerunner of present day terra cotta is credited to the Helenistic period of the fourth century B. C., although the Roman terra cotta of two thousand years ago is the earliest which is in existence today. Della Robbia ware is also a very high-grade terra cotta and was probably the largest single influence in bringing about the popularity of terra cotta throughout the European countries of that period.

The first serious attempt at producing terra cotta in the United States was made by James Renwick, a well known New York architect. It was in 1853 that he introduced the product in New York and, after much difficulty, succeeded in selling it to the builders of the St. Denis Hotel to be used as a cornice. With the success of terra cotta proved as a building material the manufacturers of the product next looked for some process by which they could still add further strength and beauty in order to enable it to meet the many various uses which were rapidly being demanded of it. The industry turned to feldspar and today it is the application of this product which gives to terra cotta the hardness, strength and vitreous beauty which it possesses.

The art of covering metallic substances with a coating consisting of colored glass appears to have been long practiced by the peoples of the Far East. Just when this same art became known to the Europeans cannot be definitely stated, but the fact that it has been practiced for several centuries is evidenced by the presence of variously colored specimens of enameled work to be found in different European museums. From its early beginning, the use of glass fluxes and enamels was almost entirely confined to the decoration of articles of value and jewelry, but the last century has seen the artistic give way more and more to the industrial application, until today the enameling industry is an outstanding institution of its own. Would it not indeed be a strain on the imagination to again visualize the old-time rusty cup, the warped and unsanitary wooden sink, the bent and corroded signs and the various other articles which have been outdated by enamel ware. Feldspar can justly be proud of the honors it claims in its relation to this tremendous and progressive industry, for in no other place does feldspar play a more important role. Without it there could be no enamel with the smooth, hard and heat resisting surface which feldspar contributes to it.

As an ingredient of glass, feldspar became of importance during the recent development of laboratory research and the rapidly increasing application of chemistry to the industries. Feldspar's peculiar adaptability to glass is shown by the fact that of the five ingredients specified for a glass suitable for X-ray tubes, three of the five are natural constituents of the variety of feldspar known as albite. In addition to the adaptability of this raw material in the manufacture of all glassware, it plays an important part in the production of glass used to imitate marble, chiefly for table tops, floors and walls. Recent experiments have shown that feldspar gives an increased viscosity to glass which in conjunction with our modern mechanical means of production has enabled the American manufacturer to greatly exceed the Europeans in production, strength and quality.

The term abrasives can, in general, be said to include any hard and rough material which will wear away another one when friction is applied between the two, but from common usage, the term is more definitely understood to include only those materials which are used for grinding purposes on a commercial scale. Listed among these are: corundum, emery, carborundum, pumice, garnet, quartz, sand, powdered glass and diamond dust. Feldspar's importance in the abrasive industry is chiefly in its relationship with what are known as grinding wheels, which have become the most popular artificial abrasive. American manufacturers of these grinding wheels have continually strived to give them greater strength to enable them to revolve at the highest possible speeds without danger of breaking, and in their efforts, have employed feldspar to bind together the abrasive minerals used in their composition.

Spar rock is mined by both the open and the tunnel methods, the operation itself being somewhat different from the mining of coal, iron ore and other such minerals. The mining of feldspar is a difficult one and requires particular attention. The yield of the average mine of merchantable spar is about 25 per cent of the total rock mined. After the raw material comes from the mine, it is of various sizes and shapes and contains a quantity of quartz, mica, and other foreign substances. The spar rock must next be transported to the mills. This is also an important part in the mining of feldspar, inasmuch as the feldspar deposits are, in general, located long distances from the nearest transportation which necessitates the feldspar producer building many miles of trackage through the mountains and rough country in which his particular deposit may be located.

The feldspar is then separated from these foreign substances and each piece of spar is graded and hand-picked to insure its purity. Extreme care is taken to see that feldspar containing certain chemical elements is not mixed with other feldspar containing different chemical elements. In this way it is possible to supply any particular kind of feldspar which the manufacturer desires. Some users are of the opinion that the spar rock secured by the tunnel process is of a better quality than

that which is obtained from the open-cut mine, although there has never been a reason why this is the case. The important point so far as the user is concerned is that an established standard be maintained.

To those in the industry, the future of feldspar can, of course, be pictured more vividly and definite than to those not so familiar with feldspar's use, but could not even the modern school boy or girl easily imagine the new and undeveloped uses to which feldspar will undoubtedly be put? What would the layman today think of the idea of enameling the Brooklyn bridge or New York's elevated structures to protect them from rust and corrosion? Probably their thought would be the same as the thought of enameling a bath tub in Civil War days, and yet today, the once popular and elegant tin bath tub is an antique.

It is natural that there are obstacles still to be overcome in the feldspar industry, but those already overcome have been of no less magnitude. Many of the present obstacles which might possibly have a tendency to retard progress and expansion can be best eliminated by the users of feldspar themselves, although the responsibility of providing the means to this end very rightfully falls upon the shoulders of the feldspar producers. With this fact in mind the producers are continually striving to give the consuming ceramic industry all possible knowledge of the methods of using feldspar, with the belief that the future of the industry will develop more or less in direct proportion to the knowledge they are able to impart.

If it be true that our twentieth century civilization is founded on steel, it is equally true that the super-structure is largely dependent on feldspar. Indeed, measuring a civilization by its refinements and by the things that make those refinements possible, feldspar rivals steel itself in the value of contribution to modern life. Most particularly does this apply to the sanitary, electrical, chemical and medical fields and lastly, but by no means the least, is the tremendous use of feldspar in that great realm comprising the home, where every day the housewife depends on the vast number of articles containing feldspars.

Iron, forerunner of steel, was known to man for ages before he learned to make steel, but we have unquestioned evidence that felspathic clays were used by potters centuries before the discovery of iron, yet, outside of the industries in which it is used, feldspar is practically unknown. Research in the field of metallic alloys made this the age of steel. A similar intensive study in the field of ceramic alloys is bringing feldspar into its own. In the hope that it may create a greater appreciation of feldspar, this article is respectively dedicated to the executives, ceramic engineers, chemists and workmen of the industries in which feldspar has a place.

Floatstone Company Prepares

(*Continued from page* 86)

liams mill has shown a capacity of 4½ tons per hour but, inasmuch as the exhaust pipes from the mill are not capable of handling the material at that rate, the mill has been cut back to 3 tons per hour. A Sturtevant fan pulls the material from the mill and blows it to a cyclone which effects a separation of the fines and the relatively coarse material. The fines pass to a bag-house, while the coarse stuff drops to a 9-in. screw conveyor.

This screw conveyor draws the material from the bin and discharges it into another blower, wherein a second blast of hot air is introduced to further dry the material. This blower discharges into a second cyclone which, in turn, discharges into a 9-in. McKain reversible screw conveyor, the fines from this second cyclone passing to a second bag-house for sacking.

This reversible screw conveyor furnishes an additional flexible unit in the mill. The conveyor, as stated, discharges into a bin for sacking but it may be reversed to convey the material to the Lewellyn 5½-ft. by 65-ft. rotary kiln. The material is calcined in this kiln at a temperature ranging between 1,900 and 2,400 deg. F., the specific temperature depending largely on the ultimate use of the produce.

The calcined material falls from the kiln into a dust chamber which, in a measure, serves as a cooler. It is then conveyed by two 9-in. McKain screw conveyors to a chamber, from which it is conveyed by air to a cyclone, and thence to a bag-house and packed.

The plant, when completed, will have a capacity of 75 tons of the various products each 24 hours.

The company is officered by T. W. Hensley, president; W. L. Heater, vice-president and general manager; J. A. Roberts, secretary; and W. B. Roberts, treasurer. E. S. Hastings acts in a consulting capacity on operations. R. B. Sage is superintendent of operations. The executive and sales offices of the company are located at 420 Wall Street, Los Angeles, Calif.

Use of Lime in Soap Making

Lime is used for neutralization of glycerine sweet waters in the soap-making process. The glycerine water is obtained by steaming the mass of melted and purified fat with about one-third its volume of water in the presence of a predetermined quantity of saponifier reagent. This mixture is kept slightly acid with sulphuric acid during the boiling process. After settling, the glycerine water is drawn off, neutralized with lime, and evaporated to crude glycerine. The residue of fatty acids is again neutralized with lime to remove all soluble acids before the fatty acids are stored.

Compressive Strength of Slag Concrete

THE National Slag Association of Cleveland, O., has published Symposium No. 18 of a series describing the characteristics and uses of blast-furnace slag. This symposium, entitled "Compressive Strength of Slag Concrete" quotes statements made by authorities, articles from engineering magazines and technical papers on this subject.

Compressive Strength of Slag Concrete Using Natural Sand

Many tests have been conducted which show that slag concrete if properly made has at least as great strength as gravel or limestone concrete. The *Technical News Bulletin* of the U. S. Bureau of Standards for August, 1926 in an article, "Proportioning and Grading Aggregates for Concrete Strength," states that slag concrete is superior to other kinds due largely to the angular shape, rough surfaces and cellular structure of the slag.

An extensive series of tests on over 200 individual specimens over a period from 1916 to 1926 was made by the Pittsburgh Testing Laboratory. Traprock, granite, limestone, dolomite and slag from nine different sources with different chemical analyses were represented. These were broken at ages of 14, 30, 60 and 180 days and 1, 2, 3, 4, 5 and 10 years. The results of these tests were reported by P. J. Freeman in an article "Long-Time Tests of Concrete Using Various Coarse Aggregates," published in *Engineering News Record,* December 1, 1927. The results showed the slag concrete samples in most cases to be stronger than those using other aggregates.

Prof. J. H. Dorroh, Dean, University of Mississippi, in a report to the Birmingham Slag Company October 4, 1922, gives the results of tests made at the university. A 1-2-4 mix was used and the cylinders tested at 28 days. The average strengths were 2,355 lb. per sq. in. for the slag aggregate, 2,080 lb. per sq. in. for the limestone and 2,060 lb. for the gravel. The storage was 7 days in air and 21 days in water.

Dr. A. Guttman, research director, Eisen Portland Cement Association, Dusseldorf, Germany, in "Use of Slag in the Building Industry," published in 1919, reports that concrete made in Germany with 6 different slags averaged 4,547 lb. per sq. in. at 28 days in a 1-2-3 mix, while Rhine gravel concrete under the same test conditions averaged 3,889 lb. per sq. in.

A number of tests have also been made of slag concrete used in the construction of roads and buildings. "For example, during the construction of a 17.5 mile slag concrete road in Alabama in 1924, many cylinders were tested in compression, averaging 4,633 lb. per sq. in. at 28 days in a mix with the following proportions—1-2.27-3.30. This was one of the first concrete roads in the country to be constructed under a designed mix, the compressive strength for which the design was computed being 3,000 lb. per sq. in. at 28 days in this case. The maximum strength obtained was 6,271 lb. per sq. in., and all cylinders ran over 4,000 lb." "Chilton Concrete Road Attracting Attention." *Dixie Manufacturer,* June 10, 1925.

Results of tests on twenty-five cores taken from the road described above were reported by W. H. Brooks, engineer, Birmingham Slag Co., in "Salient Features in P. C. A. Short Course," a paper presented at the 1925 annual meeting of the National Slag Association. They showed an average strength of 4,355 lb. per sq. in.

When the Berea Road near Cleveland, O., was resurfaced with slag concrete during 1926, both cylinders and cores were used as strength indicators. An article "Resurfacing a Brick Pavement with Concrete," published in *Concrete Highway Magazine,* October, 1926, says that the contractor was allowed to determine his own proportions but that the concrete must have a compressive strength of at least 3,000 lb. per sq. in. at 28 days. At 90 days, nine of the cores tested had an average strength of 3,948 lb. per sq. in. while the remaining 24 cores withstood 4,377 lb., the maximum pressure of the testing machine used, without failure.

Concrete bricks made with slag aggregate have also shown good test results. Cecil J. Allen in "Production of Iron and Steel for Railway Purposes" published in *Railway Engineer,* 1925, says that concrete bricks made in England with granulated slag as aggregate have been proven by tests to be equal in strength to ordinary bricks with a considerably lower cost.

Concrete brick with granulated slag aggregate, made by E. P. Gangewere, Fritz Engineering Laboratory, Lehigh University, Bethlehem, Pa., in the proportions of 1-12 tested 8,500 lb. per sq. in. compression. An article "Tests of Bricks Made from Slag" published in *Concrete,* August 15, 1922 says that these bricks have a strength far above the average clay or shale brick. The A. S. T. M. specifications for vitrified building brick call for 5,000 lb. as the average minimum compressive strength.

The "Report from E. L. Conwell and Company, Philadelphia," reprinted in pamphlet by the Edison Portland Cement Company in 1926, gives results of tests made on slag concrete blocks. These were made in three mixes, 1-1 1/3-5, 1-2-5 and 1-3-6. The usual specification for concrete block calls for a compressive strength of 700 lb. per sq. in. gross area at 28 days. This strength was reached by the

samples at 8, 4 and 6 days respectively for the three mixes used. All tested over 1,000 lb. at 28 days.

A. T. Goldbeck, at that time with the Testing Laboratory, Bureau of Surveys, Philadelphia, Pa., in a paper "Reinforced Concrete Sewer Pipe," presented at the 1914 annual meeting of the A. C. I., reported concrete pipe tests using both slag and traprock as aggregates. A quotation from this report follows:

"In tests of circular and egg-shaped reinforced concrete sewer pipe, the few tests of slag concrete pipe indicated that concrete containing broken slag aggregate is more impermeable than that made with broken stone, and also slightly exceeds the latter in strength and stiffness. The materials used were portland cement which satisfactorily passed the standard tests, New Jersey bank sand, and well-graded ¾-in. traprock. Four experimental sections were also made of concrete containing ¾-in. graded air-cooled blast furnace slag. The concrete was machine-mixed in the approximate proportions of 1-2-3½. The behavior of the experimental pipe made with coarse aggregate of blast furnace slag is interesting in indicating that the strength and stiffness of the pipe of this material equalled or even slightly exceeded those of pipe made with crushed trap aggregate."

Slag Lime Bricks

F. M. Lea and F. L. Brady, Department of Scientific and Industrial Research, London, England, in "Slag, Coke Breeze and Clinker as Aggregates" Special Report No. 10, of that department, state that English bricks made from granulated slag and lime have a compressive strength of from 2,000 to 4,000 lb. per sq. in. as compared with 3,000 lb. for first-class sand-lime brick.

Civil Engineering, in an article "Bricks from Blast Furnace Slag" published February 20, 1925, notes the manufacture of slag-lime bricks in England. These showed an average compressive strength of 4,838 lb. per sq. in. with the first cracks appearing at 3,264 lb. per sq. in.

Compressive Strength of Consolidated Slag

Henry F. Gilg, member, Engineer's Society of Western Pennsylvania in the 1915 *Proceedings* of that society describes bricks made by the pressure method using a mixture of air-cooled and granulated slag, but no cement. These were cured by waste gases from the blast furnaces and attained a compressive strength of 3,500 to 4,400 lb. per sq. in.

"Compression Tests of Reconsolidated Slag" Report of Lewis Institute, August 6, 1923, describes the removal of a section of Van Buren Street, Chicago, in 1923. The fine slag under the street car tracks was found to have cemented together in such a firm bond that it was possible to cut cores for the purpose of testing. One of the samples tested 1,470 lb. and the other, 1,060 lb. per sq. in.

Compressive Strength of Concrete Containing Slag Admixture

Several series of tests have been conducted in order to determine the effect of finely powdered admixtures on the strength of concrete. Duff A. Abrams, at that time professor in charge of laboratory, Lewis Institute, Chicago, experimented with clay, fluorspar, brick, hydrated lime, kaolin, kieselguhr, lava, limestone, natural cement, sand, tufa, whiting, yellow ochre and granulated blast furnace slag as admixtures to gravel concrete and found that all the admixtures except slag reduced the strength. In the case of slag there was a definite increase.

Prof. Abrams' findings were published in the 1920 *Proceedings* A. S. T. M. under the heading "Effect of Hydrated Lime and Other Powdered Admixtures in Concrete." A quotation from this article follows:

"The results of tests with slag differed essentially from all other admixtures in that the strength of concrete was slightly increased for all quantities up to 50 per cent of the volume of the cement, which was the highest value used. This statement applies to mixes from 1:9 to 1:4, to different consistencies and ages. The 1:3 mix showed a slight loss in strength with the addition of slag. For the conditions discussed for other admixtures, the slag increased the strength 0.12 per cent for each 1 per cent added. A similar relation has been pointed out by other writers, both in this country and Europe. This result has been explained as being due to chemical reactions between the slag and certain compounds in the cement."

Strength of Slag Concrete with Slag as Fine Aggregate

Tests made here and in Germany in which slag sand and granulated slag were used have given conflicting results. Raymond Harsch, Jr., Assistant Testing Engineer, U. S. Bureau of Roads, Washington, D. C., found that the compressive strength of an all-slag concrete was not as great as that of one containing natural sand as fine aggregate. Both granulated slag and slag sand were used. The results of his tests were published in the 1923 *Proceedings* of the A. S. T. M. under the heading "Blast Furnace Slag as Aggregate in Concrete." Using the same mix and number of cylinders in each case, the results after 28 days were: granulated slag, 1,763 lb. per sq. in., slag sand 2,142 lb. and river sand 2,630 lb.

Tests reported by Dr. H. F. Kriege, in charge of laboratory, France Stone Company, Toledo, O., also show a slightly lower strength for all-slag concrete than for slag concrete with natural sand as fine aggregate. Cylinders made with a mix containing

six sacks of cement to the cubic yard of concrete tested at 28 days gave results of 3,478 lb. and 3,627 lb. per sq. in. for natural sand and 2,547 lb. for slag sand. Similar results are reported from other tests made in this country.

German concrete test results, however, show that granulated slag makes a concrete equally as strong as that made with natural sand. Dr. A. Guttman, in a report to the German Iron Works in January, 1927, says that his experience shows slag concrete to be often superior to sand concrete. Using a 1-2-3 mix and tests at 28 days slag had an average strength of 3,191 lb. per sq. in. and sand 2,717 lb. when stored in air, and 3,196 and 2,788 lb. per sq. in. respectively when stored in water. At five years of age, practically the same relations held true.

Other Concretes with Slag as Fine Aggregate

Prof. D. A. Abrams in "Stone Screenings as Fine Aggregate for Concrete" published in *Concrete*, April, 1923, shows that in a gravel concrete of 1-4 proportions by volume natural sand as fine aggregate gave greater strength than slag, traprock, granite or limestone screenings. Results at 28 days were in the order named, 3,050 lb., 2,430 lb., 2,430 lb., 2,830 lb. and 2,610 lb. per sq. in. At one year results were 5,330 lb., 4,690 lb., 4,550 lb., 5,180 lb., and 4,680 lb. per sq. in., slag being superior in this case to limestone and traprock.

Slag Mortar

Slag as the aggregate in mortar or plaster seems to give the same strengths as natural sand or a little higher. H. N. Snyder, manager, Buffalo Slag Company, in a paper "Processing Fine Slag for Use in Wall Plaster," presented at the 1925 meeting of the National Slag Association, gave the results of tests at 28 and 90 days using 1-3 mortar and 2-in. by 4-in. cylinders. Each result is the average of four specimens. Ottawa sand at 28 days tested 2,247 lb. per sq. in. and slag sand 2,547 lb. At 90 days, the results were 3,130 lb. and 3,742 lb. respectively. Numerous other tests quoted give results showing approximately equal strengths for these two types of concrete.

Lumnite Cement Concrete

The only record quoted on the compressive strength of slag concrete using Lumnite cement is the "Report of Crushing Tests," published by the Alleghany County Department of Public Works, Pittsburgh, in 1924. An excerpt of this follows. In this test "the mix was 1-2-4 and showed the following strengths in 6-in. by 12-in. cylinders molded from the concrete being placed: At 24 hours, 2,880, 2,840 and 2,820 lb., averaging 2,845 lb. per sq. in. At 7 days, the strengths shown were 3,444 and 4,444 lb., averaging 3,944 lb. per sq. in., thus justifying the claims for high-alumina cement that it produces 28-day concrete in a much shorter period."

Conclusions

The abstract closes with a summary of the published records which is reprinted in full:

"From the foregoing data the logical conclusion is reached that properly made slag concrete with natural sand as fine aggregate will equal if not surpass other comparable concretes in compressive strength, and that a concrete with well-graded air-cooled slag as fine aggregate will also show satisfactory strengths, although probably not as high. The high strength of slag concrete is attributed to several factors—angularity and cellular texture of the slag aggregate principally, which provide a bond unexcelled by any other aggregate. The fact that slag takes water out of the mix to be used later in curing the concrete is also of great benefit from the standpoint of high strengths. There is also a chemical similarity between slag and portland cement which may help in the hardening process. The density of the material seems to have no effect on the compressive strength since the strength of the aggregate itself is in all cases beyond the ultimate strength of the mortar which fails first in the compression test. Since the compressive strength is believed by most concrete authorities to be a very good general indication of the quality of concrete for most uses it is safe in assuming that the high compressive strength of slag concrete is a very fair criterion of its all-round first-rate quality."

Indiana Sand and Gravel Association To Meet in Indianapolis

The annual meeting of the Indiana Sand and Gravel Association will be held Friday, December 6, 1929 in Claypool Hotel, Indianapolis. This particular date was set for the meeting because it is one day later than the annual meeting of the Road Contractors' Association at the same place, and persons who desire to attend either meeting will be welcomed at both meetings.

Recreations in Mathematics

A volume having the above title was printed first in 1917. So popular has the book proved that it was given its fifth printing this year by the D. Van Nostrand Company, Inc., 250 Fourth Ave., New York, N. Y. Its author is Dr. H. E. Licks, who conceived a sort of scrap-book comprising hundreds of interesting little problems selected from all branches of mathematics. It is not intended to be a textbook, but is written in language that is comprehensible by everyone, and its purpose is to show how mathematics can be applied in recreation. Whether you are an amateur or an expert, your ingenuity will be stimulated and your curiosity aroused by some of the incidents, riddles and puzzles in this book which sells for $1.50, postpaid.

Items for Depletion in Resources Should Be Allowed in Income Tax Returns

By WILLIAM H. HARRISON*

[*The following discussion was contained in a private communication, and is printed because the subject is one that should prove interesting to all operators in the pit and quarry industries.—Editor.*]

IT HAS occurred to me that the present time is one in which the various associations should have compiled statistics to show the effect of depletion allowances to their respective industries. I wonder if this could not be discussed generally in PIT AND QUARRY, and its importance stressed. The next legislation having to do with depletion is certainly going to have a vital bearing on the non-metallic industry. The American Mining Congress and American Petroleum Institute have always had a share in the drafting of depletion statutes and regulations based on these statutes. The former in its recommendation to Congress on the percentage depletion plan last year put the depletion percentage it recommended for the non-metallic industries well down on the list. I think it was the lowest. The present statutes, or at least the regulations thereunder make it well nigh impossible for a gravel, cement, limestone, and many another similar industry's claim to a discovery. The difficulty is largely in the Statute and the Regulations. However, these industries have taken a fairly indifferent viewpoint.

The last report of the Joint Committee of the House and the Senate on the Bureau of Internal Revenue, which has just been issued, states as follows: "It must be concluded that the present system of depletion does not result in equity between the taxpayers in the mining and quarrying industries, nor are the valuations consistent with those allowed in other industries."

This means, as the writer happens to know, that they are very much lower in the quarrying industries, although the margin of profit on the same unit basis may be approximately the same.

It is certain that, the next time legislation comes up in connection with new tax legislation, the percentage depletion will be reintroduced, and the chances are that some such plan will go through, which will obviate the necessity for valuations. Now is the time for the non-metallic industries to gather all the statistics that they can bearing on the depletion allowances both at March 1, 1913 and at acquisition, if after that date, as well as discovery allowances, if any. These data are imperative, because there is no one better able to present their cause than they are themselves. If discovery depletion is to remain in the statute it should be of such character as to allowance, that it may be used. If it is in the statute and cannot be used by any other industry except the oil and gas, and mining, that is of no help to the non-metallic industries if, owing to their own peculiar conditions, the statute cannot be applied to their benefit.

A statute that is inapplicable has small benefit to these industries. Statistics would show this clearly, and it has always puzzled me to know how the non-metallic industries can expect to show their depletion shortages unless they make some attempt to gather statistics showing the effect of the present and past administrative practices at Washington. Certainly this information will not reach the legislators in any adequate way unless a showing among the producers is indicated. The several associations should be preparing these data at present.

* Consulting engineer, Washington, D. C.

Find Rare Variety of Clay

According to a recent press dispatch from Kingman, Ariz., Mohave County, ever remarkable for minerals of unusual sort, has added to its collection euxinite, a rare clay, said to be found elsewhere only in Norway, and containing salts of scientific value, said to be radioactive. The clay deposit is on the Big Sandy River, south of Kingman, in the Aquarius Mountains, within an area a mile wide and several miles long. The discovery was made and announced by Robert E. S. Heineman, associate geologist of the U. S. Bureau of Mines, stationed at the University of Arizona.

Several thousand tons of high-grade ore are reported by its officials to be on the dump of the Pilgrim mine, near Chloride, with a shipment of the "picture rock" being assembled for reduction elsewhere. The Katherine Treasure Vault Company, which has purchased and is developing the property, is reported to have made a large payment on its contract.

Moulding Sand Found in North Carolina

A large deposit of moulding sand, the first deposit to be reported in the state, has been opened up on a Mecklenburg County farm in North Carolina, along the Catawba River.

Age of Machinery and Its Aftermath*

By MAGNUS W. ALEXANDER
President, National Industrial Conference Board

THE United States, though still a relatively new country, shows definite signs that a period of a more settled existence has begun. The production and the whole economic life of the United States may be expected to continue to grow with the population, but development since the beginning of the current century has been directed more toward the refinement of technique, methods, and policies. Whereas an intensive individualism marked the economic life of the first half of the history of the United States, the emphasis is now shifting toward a voluntary assumption of social obligations, implied in the direction of economic activities, and of national and international cooperative effort in the common interest.

Thus, in place of the comparative wastefulness in earlier years—although the country is still amply provided with natural resources—increasing emphasis has been laid during more recent times on the avoidance of waste and the conservation of the national heritage. Instead of being hampered by a scarcity of capital and of labor, such as prevailed during the first half of its economic development, the United States today has ample financial resources; and whether or not there is an increasing labor surplus is an open question. Where formerly manufacturing was simply a production problem, producers today are realizing that they must be alert in adjusting their output to the available markets, foreign as well as domestic. As against the flair for magnitude, speed, ruthless competition, and an element of gamble, which characterized American business life in the nineteenth century, there is today a tendency toward consolidation and association for greater efficiency, careful planning on the basis of diligent research, and much concern over the effects of economic life upon social progress.

The early American characteristics, however, continue at work, and American psychology is still distinctly the psychology of a pioneer population. The advent of the machine in Europe resulted in what was properly called an industrial revolution; industry had to be made over to adjust itself to machine technique. In the United States, however, the industrial system was built up from the start with machine equipment; pioneering energy, initiative and inventiveness, and love for magnitude found, and still find, untrammeled expression in the rapidity and scale of operations which ensued and prevail today. The mobility of the workers, their comparative readiness to accept suitable employment in a new locality, are American characteristics reflecting the pioneering spirit—elements facilitating the expansion of industrial enterprise. Closely akin to this quality in the American worker is an attitude that is opposed to arbitrary restrictions of his effort, an attitude that insists on the right to seek and accept work where and under what conditions he may choose.

Favored by many circumstances, the United States thus has created a machine economy of great complexity and size, the stability of which arises from and depends upon intensive production. Increasing production per worker, whether in manufacturing, mining, agriculture or transportation, is the keynote of business policy. "Mechanization" of activities is being rapidly perfected in these industrial fields. Machinery and power, effectively organized for mass production, have supported high and stable wage earnings by reducing overhead and costs per unit of product. Besides striving to improve the economic status of the wage earners as a result of greater efficiency and productivity of the industrial process, the labor policy of management is also giving increasing attention to the human element in industry.

High wage levels, originally an incidence of labor scarcity and later of war-time demands and inflation, have become a distinct element of American economic life. In fact, a definite philosophy has arisen from the relationships of high wages, intensive productivity, and national purchasing power. The trend of American business policy today is toward the creation of widespread consumer purchasing power by providing high wages and wage values, which, in turn, tend to raise the standards of living among the masses. Thus, there is being established a "benevolent circle," extending from high wages to high consumer purchasing power, to increased demand for manufactured goods and services, and to still greater industrial production, all of which makes possible intensified mass production methods, resulting in still lower unit costs. These, in turn, lead to lower prices and thereby again raise the purchasing power of wages. The United States is constantly seeking to expand its export markets, but it is also a part of the modern American business creed that American industry's greatest potential expansion for the present lies in an expanding domestic consumption.

Perhaps because in the earlier years of the nation's existence the process of building up a new physical civilization left perforce little time and opportunity for educational and other cultural pur-

* Abstract of an address, World Engineering Congress, Tokyo, Japan, Nov. 3, 1929.

suits, there has developed in the United States, in more recent decades, and especially in the last decade, an increasing passion for education along all lines of knowledge. Free primary education for all was a natural principle to find expression under a democratic regime; and higher education for all who may desire it, not necessarily with the view of following one of the professions but as a general preparation for life, has become a peculiarly American ideal.

No one can foresee the destiny of this so-called machine civilization that is America. The United States is now at the beginning of a new period in its history, in which it has to sustain a great momentum in production and even further increase it, and in which it should progressively provide for its people a high material standard of living widely diffused among the masses. This machine civilization is viewed askance by many, because it is believed to engender materialism and to encourage undue indulgence in luxury and pleasure seeking. Such, of course, is the natural and immediate tendency whenever people find their income materially and quickly increasing. But it is not necessarily the only or ultimate effect of more easy economic circumstances. Besides having placed within the reach of the American people at large, automobiles, radios, telephones, and sanitary and comfortable living quarters, and thus having made necessities out of many things which in former years were classed as luxuries, the present prolific, mechanistic age has also immensely widened the intellectual horizon of the masses by making travel, education, and enjoyment of art and literature available to the many who formerly had to spend their time and energy in just making a living. Greater leisure and economic well-being have paved the way for a broader American participation in cultural endeavors; and the immense increase in educational activities and travel is evidence that the people are eager to avail themselves of this opportunity. Thus, in the future, not only a favored few but an increasing number of all the people in the United States will, thanks to the machine and its social as well as economic effects, find the doors open to a fuller cultural and spiritual life.

Bedford Stone to Re-cover Famous Building

The Fine Arts Building of the Columbian Exposition held in 1893 at Chicago, was the last one to succumb to the wrecker. This great, magnificent building in Jackson Park was of steel constructon with stucco walls. It is to be completely refinished, to become a museum of industry, and its walls and all decorative portions will be built of Indiana's splendid limestone.

Utilize Mineral Resources Near Points of Production

Utilization of natural resources near their point of production was recommended by Dr. Henry Mace Payne, consulting engineer to the American Mining Congress, in addresses last week in Kentucky on "The New Trend in Industry." Dr. Payne spoke at Owensboro, at Bowling Green, and Lexington, at joint banquets of the Chambers of Commerce of those cities and of the Kentucky Progress Commission to advance the interests of the state.

"In the application of economic laws to the industrial development of the nation we must focus the attention of capital on our undeveloped resources and their utilization," said Dr. Payne. "The small town, once shunned by industry, is now brought by good roads, power and telephone lines into more favorable situation. Shipping facilities are less crowded, production efficiency is speeded up through conservation of human energy in getting to and from work, the health of the worker is invariably better, and expeditious disposition of the product means less investment tied up in raw and manufactured goods. We have grown complacent and ship our clays from Georgia to New Jersey, our bauxite from Arkansas to North Carolina, our magnesite from Washington to Illinois, our paint rock from Mississippi to Massachusetts, our bentonite from California to Louisiana and our fuller's earth from Texas to New York, only to buy them back at tremendous increase in price, processed or fabricated into dishes and porcelains, spark plugs and linoleums, aluminum ware and abrasives, refractory brick and water colors, and soap and packing house products. Brains and capital are not lacking at the source of the raw material. The present and coming generation must be familiarized with the economic factors of industry if we are to achieve a well rounded, diversified development of our natural resources. We need to study and classify our resources and bring about developments in the intelligent utilization of our metals, clays, refractories, pigments, tin, cinnabar, filtering and dye earths, building stones, travertine, phosphate, rock, manganese, tripoli, asbestos and graphite. The first step to be taken is an inventory of the materials sent out of the State for fabrication and repurchased in manufactured form, a knowledge of imported articles susceptible of production and fabrication within the State, and a detailed study of new markets for the products of the State which are available to new centers of distribution. It is important to know what industries are needed to supplement existing industries and what kinds of production are over-emphasized in order to discourage further expansion in fields which offer little or no opportunity for success."

MEN OF THE INDUSTRY

The portrait printed on this page in each number of PIT AND QUARRY is selected without significance as to current events or the position of the individual in the industry.

© Blank-Stoller, Inc.

Sterling Tomkins

Vice-president, New York Trap Rock Corporation,
New York, N. Y.

Standard Concrete Material Specifications

By Robert Seth Lindstrom

THE writer, having spent several years actively engaged in the Portland Cement Industry, thereby coming into close contact with architects, engineers, contractors, building material manufacturers and dealers, has found that there are many different interpretations of the exact meaning of the wording in architects and engineers specifications. This is primarily due to great variations in estimates and costs from contractors to architects and owners, also the reason for variations in prices by building material manufacturers and building material dealers to the contractor.

There are probably no two architects or engineers who write their specifications alike for the same kinds of building materials, due to the attempt on the part of the architect to over-specify certain building materials and to under-specify others. In many instances, architects specify trade names of materials and in some instances, if the trade name and the manufacturer of same have gone out of business, it cannot be purchased.

For example, take the items of materials that are contained in portland cement concrete specifications which include portland cement, sand and coarse aggregates, such as gravel, crushed stone or trap rock, which require more specific and detailed information regarding fineness, grading from fine to coarse, and the quality of each material.

First, let us consider portland cement, where the writer has found as many as a dozen brands of portland cement specified, among them being "Chicago A. A.," which brand has not been on the market for a number of years. In addition to specifying brand and name of manufacturer of the portland cement, several pages of technical specification are written, giving methods of manufacture, which is a waste of time and money on the part of the architect in these times of standardization in building materials.

All portland cement manufacturers aim to meet with the standard specifications for portland cement that meet with the requirements of the American Society for Testing Materials, also the United States Government Standard specifications for portland cement.

Consequently, if the architects or engineers will simply specify the item of portland cement as follows, they will obtain a standard portland cement. The proposals from the contractor and material dealer in the locality of the contemplated building will be based on the costs of the manufacture, coupled with the cost of transporting the cement from the manufacturers and their representative dealers to the particular locality or the site of the contemplated building or structure.

Specification for Portland Cement

"Portland cement shall be manufactured and sold in accordance with the standard specifications for portland cement meeting with all requirements of the American Society for Testing Materials."

The manufacturer, or brand name of portland cement to be used shall be agreed upon when awarding the contract.

The next item for Concrete Specifications is the sand. Most architects specify sand as clean, sharp torpedo sand, free from loam and impurities.

The word "torpedo" happens to pertain to some of the sand obtained in the Chicago market, but has nothing to do with the proper grading of the sand and therefore, in writing a concrete specification, the grading of the sand from fine to coarse is more important for a sand specification than the word "torpedo" or any other name pertaining to the quality of the ingredients contained in the sand.

It so happens that the so-called Torpedo sand obtained in the Chicago market has a uniformity of grading that meets with Fuller's formula for ideal sands, except that after being washed no percentage of fine sand passes a one-hundred mesh sieve.

Some architects and engineers specify that a certain percentage of fine sand shall pass a one-hundred mesh sieve—therefore, it becomes necessary to manufacture a sand having the proper grading and fineness for the sand or fine aggregate which shall have a certain percentage of fine washed sand passing a one-hundred mesh sieve.

Therefore, it is more important for the architect or engineer to specify the quality, also the fineness or grading of the sand, or fine aggregate in the specifications.

Some producers in the Chicago District are now engaged in arranging and setting up their machinery, preparatory to producing a sand of standard specification similar to a standard portland cement specification so that in specifying sand or fine aggregate, the architect or engineer will be able to specify and obtain a standard manufactured sand, meeting with their specifications for portland cement concrete.

For the present, the following specifications will serve as a standard specification for sand:

Specification for Sand or Fine Aggregate

Sand shall be washed, clean, sharp sand, free from all impurities and silt graded in fineness by percentage in weight passing through standard sieves with square openings as follows:

Specification for Ideal Sand Grading

4 mesh to the inch passing 100 per cent.

8 mesh to the inch passing 75 per cent.

14 mesh to the inch passing 50 per cent.

28 mesh to the inch passing 25 per cent.

48 mesh to the inch passing 15 per cent.

100 mesh to the inch passing 5 per cent.

The third item is coarse aggregate, and whether it be of gravel, crushed stone, or trap rock, like the sand or fine aggregate should also meet with a standard specification of grading for coarse aggregate used in portland cement concrete. The following specifications are recommended for coarse aggregate:

Specifications for Coarse Aggregate

Each grain shall be clean, hard, durable and free from alkali, organic or other deleterious matter and also free from dust and graded or ranging in size from one inch down to one sixteenth, percentage by weight passing through standard sieves with square openings as follows:

Specification for Coarse Aggregate Grading

1 inch mesh to the inch passing 100 per cent.

½ inch mesh to the inch passing 75 per cent.

¼ inch mesh to the inch passing 10 per cent.

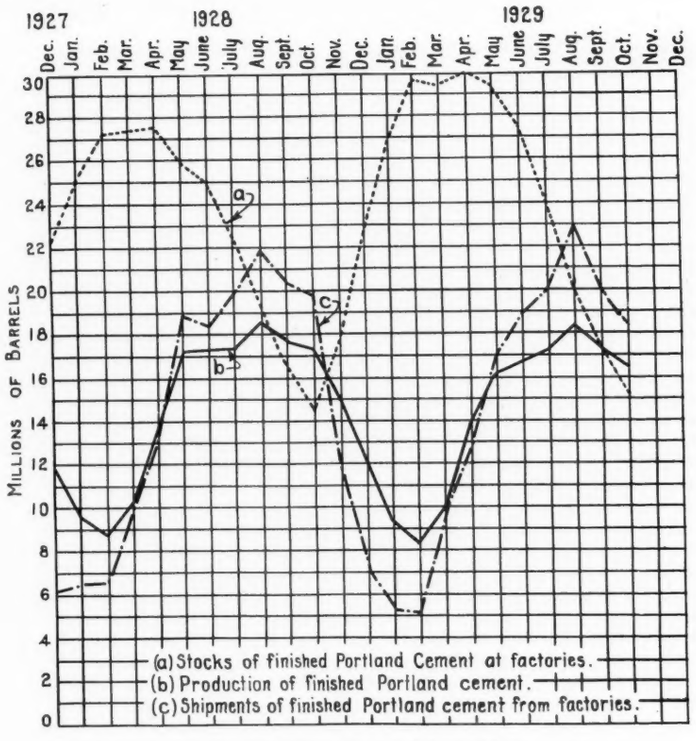
⅛ inch mesh to the inch passing 5 per cent.

1/16 inch mesh to the inch passing 0 per cent.

Quantity of Each Material

The amount or quantity of each material required, namely, portland cement, sand or fine aggregate and coarse aggregate, together with a quantity of water and mixing time will depend upon the tensile and com-

(*Continued on page* 103)


1927
1928
1929
Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
Millions of Barrels
30 28 26 24 22 20 18 16 14 12 10 8 6 4 2 0
a
b
c
(a) Stocks of finished Portland Cement at factories.
(b) Production of finished Portland cement.
(c) Shipments of finished Portland cement from factories.

Portland Cement in October, 1929

Production, shipments, and stocks of finished Portland cement, by districts, in October, 1928 and 1929, and stocks in September, 1929. (In thousands of barrels)

District	October Production 1928	1929	Shipments 1928	1929	Stocks at end of month 1928	1929	Stocks at end of Sept., 1929a
Eastern Pa., N. J., and Md.	3,743	3,571	4,753	4,043	4,011	3,980	4,452
New York and Maine	1,204	1,129	1,375	1,407	1,102	996	1,274
Ohio, Western Pa., and W. Va.	2,120	1,731	2,294	2,176	1,985	2,240	2,685
Michigan	1,550	1,437	1,673	1,323	757	1,075	961
Wis., Ill., Ind., and Ky.	2,238	1,935	2,646	2,346	924	1,329	1,740
Va., Tenn., Ala., Ga., Fla., and La.	1,561	1,306	1,576	1,419	1,619	1,498	1,610
Eastern Mo., Ia., Minn. and S. Dak.	1,599	1,718	1,705	1,870	1,466	1,273	1,426
W. Mo., Neb., Kans., Okla and Ark.b	1,190	1,331	1,361	1,508	993	621	798
Texas	617	777	552	743	346	527	492
Colo., Mont., Utah, Wyo.b and Idahob	199	323	282	346	304	451	475
California	1,177	1,179	1,257	1,183	687	937	941
Ore. and Wash.	335	294	362	331	385	434	471
	17,533	16,731	19,836	18,695	14,579	15,361	17,325

Production, shipments, and stocks of finished Portland cement, by months, in 1928 and 1929. (In thousands of barrels)

Month	Production 1928	1929	Shipments 1928	1929	Stocks at end of month 1928	1929
January	9,768	9,881	6,541	5,707	25,116	26,797
February	8,797	8,522	6,563	5,448	27,349	29,870
March	10,223	9,969	10,135	10,113	27,445	29,724
April	13,468	13,750	13,307	13,325	27,627	30,151
May	17,308	16,151	18,986	16,706	25,984	29,624
June	17,497	16,803	18,421	18,949	25,029	27,457
July	17,474	17,281	19,901	20,295	22,580	24,525
August	18,759	18,585	21,970	23,052	19,374	20,056
September	17,884	17,223	20,460	19,950	16,799	a 17,325
October	17,533	16,731	19,836	18,695	14,579	15,361
November	15,068	.....	11,951	.....	17,769	.....
December	12,189	.....	7,384	.....	a 22,918	.....
	175,968	.....	175,455	.....	.....	.....

Production and stocks of clinker (unground cement), by districts, in October, 1928 and 1929. (In thousands of barrels)

District	Production 1928	1929	Stocks at end of month 1928	1929
Eastern Pa , N. J., and Md.	3,265	3,202	867	962
New York and Maine	1,103	1,045	627	441
Ohio, Western Pa. and W. Va.	1,856	1,578	530	476
Michigan	1,303	1,350	527	465
Wis., Ill., Ind. and Ky.	2,122	1,779	217	367
Va., Tenn., Ala., Ga., Fla. and La.	1,445	1,205	719	603
Eastern Mo., Ia., Minn. and S. Dak	1,444	1,657	292	499
W. Mo., Neb., Kans., Okla. and Ark.b	1,089	1,286	303	190
Texas	570	793	112	293
Colo., Mont., Utah., Wyo.b and Idahob	222	283	315	274
California	1,089	1,059	1,156	944
Ore. and Wash.	274	283	279	400
	15,782	15,520	5,944	5,914

Cement Statistics for October, 1929

The portland cement industry in October, 1929, produced 16,731,000 barrels, shipped 18,695,000 barrels from the mills, and had in stock at the end of the month 15,361,000 barrels, according to the United States Bureau of Mines, Department of Commerce. The production of portland cement in October, 1929, showed a decrease of 4.6 per cent and shipments a decrease of 5.8 per cent, as compared with October, 1928. Portland cement stocks at the mills were 5.4 per cent higher than a year ago.

The statistics here presented are compiled from reports for October, from all manufacturing plants except two for which estimates have been included in lieu of actual returns.

In the following statement of relation of production to capacity the total output of finished cement is compared with the estimated capacity of 165 plants at the close of October, 1929, and of 159 plants at the close of October, 1928. In addition to the capacity of the new plants which began operating during the twelve months ended October 31, 1929, the estimates include increased capacity due to extensions and improvements at old plants during the period.

Concrete Specifications

(*Continued from page* 102)

pressive strength required in the finished product or concrete to meet with the structural requirements for safety, density or fire resistive qualifications.

The above recommended standard of specifications and standard practice is based on results obtained by actual tests of materials in the laboratory as well as in the field of operation and construction.

Uniformity and standard specifications for concrete materials will simplify supervision and testing methods of these materials, at the same time save money for the owner, architect, contractors, manufacturers and dealers in building materials which naturally is a saving in time required in the construction of the building or structure by assurance of prompt delivery of materials specified.

Proposed Reduction in Rates on Feldspar

Shippers of Feldspar located at Erwin, Tenn., and stations on the C. C. & O. seek reductions in rates. They ask that rate of $5.00 be published to Bristol, Pa., Morrisville, Pa., and Trenton, N. J.

These proposals are covered by Southern Freight Association Dockets 47015 and 47017.

Distribution of Cement

The following figures show shipments from portland cement mills distributed among the States to which cement was shipped during August and September, 1928 and 1929.

Portland cement shipped from mills into States in August and September, 1928 and 1929, in barrels.*

Shipped to—	August		September	
	1928	1929	1928	1929
Alabama	315,341	271,466	255,120	179,011
Alaska	382	2,105	277	282
Arizona	57,033	57,184	56,940	56,000
Arkansas	150,173	187,688	136,794	206,476
California	1,166,958	1,007,181	1,020,406	915,829
Colorado	147,267	105,397	140,150	91,602
Connecticut	279,631	241,126	233,257	206,737
Delaware	29,447	56,135	34,578	34,281
District of Columbia	83,553	125,732	81,703	107,654
Florida	105,108	100,975	98,859	88,730
Georgia	181,254	160,279	155,421	117,262
Hawaii	25,413	26,037	21,378	24,896
Idaho	45,284	26,051	30,886	27,375
Illinois	2,581,921	1,969,576	2,553,958	1,721,624
Indiana	804,868	990,059	847,440	909,295
Iowa	813,328	1,108,711	738,450	968,958
Kansas	233,127	338,052	272,461	332,819
Kentucky	216,674	205,597	211,690	176,115
Louisiana	125,319	172,697	112,202	171,673
Maine	71,721	79,258	79,289	94,201
Maryland	260,189	323,021	227,573	294,089
Massachusetts	308,837	365,297	315,939	356,318
Michigan	1,707,324	1,891,753	1,692,432	1,601,684
Minnesota	401,260	533,434	377,096	430,298
Mississippi	122,486	131,963	129,970	107,651
Missouri	541,927	896,327	554,767	748,870
Montana	66,954	89,417	59,124	77,505
Nebraska	127,833	270,919	159,659	224,168
Nevada	14,101	12,186	13,635	14,180
New Hampshire	69,903	116,275	72,947	75,573
New Jersey	878,977	958,357	884,759	825,204
New Mexico	43,079	29,932	27,552	21,621
New York	2,774,981	2,768,232	2,398,193	2,237,801
North Carolina	218,950	149,085	167,910	129,411
North Dakota	61,931	47,870	43,739	49,597
Ohio	1,549,784	1,364,665	1,410,196	1,207,197
Oklahoma	286 023	371,205	361,360	365,927
Oregon	175,733	124,852	132,521	122,669
Pennsylvania	1,699,137	1,710,648	1,519,073	1,632,356
Porto Rico	.....	6,995	500	4,190
Rhode Island	71,291	101,278	77,316	81,919
South Carolina	152,387	89,733	108,575	64,446
South Dakota	62,440	55,114	58,274	83,173
Tennessee	323,794	481,869	353,282	358,182
Texas	690,901	877,463	515,419	697,091
Utah	65,376	57,547	49,468	73,952
Vermont	103,293	181,612	108,095	135,894
Virginia	214,602	205,771	173,104	161,521
Washingron	408,566	310,711	291,994	305,056
West Virginia	166,289	209.590	166,816	164,543
Wisconsin	809,545	952,914	791,171	759,187
Wyoming	30,976	26,480	27,555	24,015
Unspecified	30,779	49,633	41,593	22,207
	21,873.450	22,993,454	20,392,866	19,888,315
Foreign Countries	96,550	58,546	67,134	61,685
Total shipped from cement plants	21,970,000	23,052,000	20,460,000	19,950,000

*Includes estimated distribution of shipments from three plants each month.

Relation of Production to Capacity

	October		September	August	July
	1928	1929	1929	1929	1929
	Per cent	Per cent	Per cent	Per cent	Per cent
The month	87.1	77.0	81.8	86.1	80.4
The 12 months ended	73.8	67.3	67.5	68.2	68.9

Production and stocks of clinker, by months, in 1928 and 1929. (In thousands of barrels)

Month	Production		Stock at end of month		Month	Production		Stock at end of month	
	1928	1929	1928	1929		1928	1929	1928	1929
Jan.	11,839	12,041	9,672	9,642	July	15,981	15,180	11,707	11,619
Feb.	11,363	11,255	12,237	12,436	Aug.	16,202	15,822	9,357	a 8,989
Mar.	12,501	12,450	14,463	14,948	Sept.	15,909	a15,147	7,566	a 6,985
Apr.	13,844	14,166	15,002	15,472	Oct.	15,782	15,520	5,944	5,914
May	16,025	15,445	14,329	14,911	Nov.	14,930	.....	5,953	.....
June	15,940	15,312	12,944	13,586	Dec.	13,426	.....	7,422	.....

aRevised.
bThe inclusion of Wyoming begins with April, 1929; of Idaho with June 1929; of Arkansas with September, 1929.

Exports and Imports

Compiled from the records of the Bureau of Foreign and Domestic Commerce and subject to revision.

Exports of hydraulic cement by countries in September, 1929

Exported to—	Barrels	Value
Canada	7,269	$28,706
Central America	18,553	39,476
Cuba	5,223	15,040
Other West Indies and Bermuda	4,950	14,006
Mexico	19,896	63,323
South America	24,778	114,957
Other countries	5,599	33,123
	86,268	308,631

Bucket Loader Found Profitable

Changing the size of a pit crew from fifteen men to one man reduced the cost of excavating, screening, and loading gravel to 5½ cents a yard in the pit of Jesse Sheer at Plano, Ill. This was accomplished by installing a crawler mounted bucket loader.

The output of the Sheer pit is between 100 and 400 cu. yd. per day, with a maximum of between 400 and 500 cu. yd. A fair estimate of the yearly output would be 200 cu. yd. in 150 days. The entire gravel pit was dug by a Barber-Greene Model 25 bucket loader without any assistance, at the rate of better than a yard per minute. In digging the pit, trees were encountered, but they were made fast to the bucket loader and snaked out without trouble.

Proper maintenance of the machine has been a factor in reducing the operating cost. It is greased daily and well taken care of. It consumes about 5 to 7 gallons of gasoline per day, and one quart of oil. In two years of operation, the repairs on the loader have been but $100.

Bucket loader in pit of Jesse Sheer

As stated, this loader has cut down the pit crew from fifteen men to one man—who is also a truck driver—and, very often, is a thirteen-year-old boy, the son of one of the drivers. Frequently the truck drivers operate the machine themselves, loading their own trucks, as in the case of the driver for the city of Plano.

This city uses gravel from the Sheer pit for the maintenance of roads, a levee, and a dam. The driver goes to the pit, fills his truck by using the loader, and drives on, coming back for more material as it is required. At the end of the month the city pays for the gravel used. There is no labor cost to the pit owner.

Mr. Sheer says his machine will load anything that will go into the buckets, including sand, gravel, stone, and rock. Because of its power and traction, the Barber-Green is able to perform an extra duty in the pit—that of tow truck. It has pushed and pulled out a number of trucks, one of which a wrecker failed to move.

In addition to working in pits, the bucket loader is built to be used for loading and batching on road jobs, and for handling coal and coke. It is sold equipped with any one of several different kinds of standard screens and hoppers for specialized work.

Cost figures on the Model 25 loader as worked in the pit of Jesse Sheer are:

Repairs	$ 100
Labor	1,500
Depreciation	1,110
Power	285
Interest	333
	$3,328

These figures cover two years or 300 working days. In 300 working days, with the average output of 200 cu. yd. per day, the total output is 60,000 cu. yd. which, by division, gives $0.0554, the loading cost per yard.

Cement Statistics for October

American portland cement mills continue to show a decline in the ratio of operations to capacity as indicated by the figures for 12 months' period ending October 31. According to statistics released November 12 by the Bureau of Mines of the Department of Commerce, the ratio of operations to capacity for the last twelve months was 67.3 per cent. The ratio percentage has fallen from a maximum of 71.1 per cent for twelve months ending April 30 to 67.3 per cent in October.

During the month 16,731,000 barrels were produced, 18,695,000 barrels were shipped, and stocks on hand at the end of the month were 15,361,000 barrels. Production for October, 1929 was 4.6 per cent less, and shipments 5.8 per cent less than October, 1928. Stocks at the mills were 5.4 per cent higher than a year ago.

New Talc Company

The Nantahala Company has been organized by L. L. Jenkins of Asheville, N. C., to operate talc properties near Nantahala, formerly owned by the North Carolina Talc and Mining Company.

Plant to Crush Limestone in Florida

Carl G. Rose is vice-president and general manager of the Ocala Lime Rock Corporation, of Ocala, Fla., which has started the construction of a crushing plant at Haile, a station on the Atlantic Coast Lime Railroad whose post-office name is Newberry, Fla. The plant will have a capacity of 2,000 tons daily of crushed limestone that will be marketed as road material.

Imports of hydraulic cement by countries and by districts, in September, 1929

Imported from—	District into which imported	Barrels	Value
Belgium	Florida	4,500	$ 5,208
	Massachusetts	47,498	58,456
	New York	5,000	5,895
	Oregon	4,395	5,696
	Philadelphia	4,800	6,030
	Porto Rico	14,002	22,466
	Washington	1,000	1,410
	Total	81,195	105,161
Canada	Maine and New Hampshire	322	763
Denmark	Hawaii	6,149	8,988
France	New York	1,000	2,022
Germany	Los Angeles	950	1,754
United Kingdom	New York	22,756	33,551
	Grand Total	112,372	152,239

Exports and imports of hydraulic cement, by months, in 1928 and 1929

Month	Exports				Imports			
	1928		1929		1928		1929	
	Barrels	Value	Barrels	Value	Barrels	Value	Barrels	Value
January	56,400	$204,875	78,639	$283,002	236,771	$315,797	151,302	$177,976
February	62,828	221,620	58,886	225,590	164,408	217,525	118,930	123,123
March	74,983	265,719	69,079	235,164	235,930	330,074	131,909	112,788
April	61,676	205,882	64,145	218,316	249,458	324,371	89,668	114,281
May	70,173	236,005	57,955	219,366	190,509	256,872	200,646	267,854
June	59,536	201,313	96,055	287,612	266,537	359,637	203,545	228,170
July	83,759	291,055	71,992	247,177	112,887	151,877	182,098	199,960
August	88,736	302,866	60,013	225,762	259,975	358,471	183,938	199,403
September	71,995	252,843	86,268	308,631	173,439	226,295	112,372	152,239
October	62,137	246,010	.....	.....	152,210	226,909	.....	.....
November	69,313	260,310	.....	.....	65,969	89,732	.....	.....
December	63,120	250,204	.....	.....	175,992	233,300	.....	.....
	824,656	2,938,702	.....	.....	2,284,085	3,090,860	.....	.....

Domestic hydraulic cement shipped to Alaska, Hawaii, and Porto Rico, in September, 1929

	Barrels	Value
Alaska	2,251	$ 6,779
Hawaii	21,382	53,762
Porto Rico	5,816	13,156
	29,449	73,697

New D. C. Across the Line Starter

A new, automatic, across-the-line starter, for general applications of direct-current motors up to 2 hp., 115 or 230 volts, is announced by Cutler-Hammer, Inc., 189, 12th St., Milwaukee, Wis. Some new and important features incorporated in this new design are: Small size, low cost, double-line break, thermal overload protection, low voltage protection, silver contacts, and completely enclosed structure. Two magnetic contactors, one in each side of the line, connect the motor directly across the line on starting and provide a double line break. The contactors are designed especially for direct current service. They have renewable silver contacts and a heavy stamped frame.

The thermal overload relays are the same as those used in this company's a.c. across-the-line starters for small motors. They are the fusible-alloy type and can be adapted to any size motor by simply changing heater coils.

Across-the-line starter

When tripped by an overload, the relays are reset by pushing a button in the cover.

Each starter is furnished with a pushbutton master switch providing three-wire control. This master switch can be furnished mounted in the cover of the starter, or it can be arranged for mounting separately. The starter with pushbuttons in cover, is illustrated. These starters are also made without the thermal overload relays, for applications where overload protection is not required.

Cement Production For August, 1929

The ratio of the operations to the capacity of the American portland cement industry during the month of August was 86.1 per cent, according to figures released today by the Bureau of Mines of the Department of Commerce. During the month 18,594,000 barrels were produced, 23,019,000 barrels were shipped and there were in stocks on hand at the end of the month 20,101,000 barrels. Production in August, 1929 was 0.9 per cent less and shipments 4.0 per cent more than in August, 1928. Stocks at the mills were 3.8 per cent higher than a year ago.

Cement Plant Proposed at Dover, England

Negotiations have been pending for several months for the erection of a cement factory on Dover Bay. It is proposed to utilize the immense chalk cliffs of that region for the lime constituent, while excellent clay is abundant in the vicinity. Coal for fuel will be furnished by the Tilmanstone Colliery of Kent.

PERSONAL MENTION

Dr. M. E. Hurst was recently appointed to the geological staff of the Ontario Department of Mines. Doctor Hurst graduated from the University of British Columbia in 1918 and was awarded the degree of Doctor of Philosophy by the Massachusetts Institute of Technology. He has had several years' experience with the Geological Survey of Canada, later acting as instructor at Ohio State University and at Brown University.

H. McC. Larmour, chief chemist, Yosemite Portland Cement Company, Merced, Calif., recently addressed a meeting of the Merced Kiwanis Club at the Hotel Tioga in that city. His subject was the development of building through the ages, with special emphasis on the important part the portland cement industry has taken in this development.

O. E. Thaleg, sales engineer, recently joined the Chicago office of the Traylor Engineering and Manufacturing Company. He will look after the crushed stone and sand and gravel plants in the Chicago office territory which comprises eight states. "Ben" Haislip remains manager and will look after the cement plant sales. Mr. Thaleg was formerly manager of the Chicago office of the Power and Mining Machinery Company and has had 20 years of experience in this field.

Dr. William O. Hotchkiss, president of the Michigan College of Mining and Technology, at Houghton, Mich., has been made a member of the Science Advistory Committee of the National Research Council in connection with the 1933 Chicago World's Fair Century of Progress Centennial Celebration. Doctor Hotchkiss has been appointed chairman of the subcommittee on geology, the members of which he will name. This committee will develop a plan showing geological progress, to be exhibited at the Chicago fair.

Thomas Fuller, formerly manager of the Charlotte, N. C., office of the Westinghouse Electric and Manufacturing Company, has been appointed manager of the Atlanta district office to fill the vacancy caused by the recent death of H. A. Coles. Mr. Fuller has been prominently identified with many of the big electrical projects of the South and is well known in the electrical industry.

O. E. Thaleg

He graduated from the Georgia School of Technology in 1905. In 1907, he was assigned to the Atlanta office as a salesman and held many important positions until in September, 1924, he was appointed manager of the Charlotte office, which position he held until his recent appointment.

Darwin North has been appointed superintendent of the Ohio and Indiana Stone Company quarry at Greencastle, Ind. He has been in the employ of the France Stone Company for the past two years and is their youngest plant superintendent.

Captain James G. Ross, of the Milton Hersey Company, Montreal, Quebec, Canada, was recently appointed by the directors of the Asbestos Corporation, Ltd., to the position of mines manager at Thetford, Quebec.

Captain Ross has for some time been consulting engineer and assistant to the president and has had wide experience in asbestos mining and milling. He was for four years consulting engineer for the Black Lake Asbestos and Chrome Company and later held the same position with the Asbestos Corporation of Canada. He has visited many of the foreign asbestos fields and recently completed a Monograph on asbestos for the Dominion Government Mines Branch.

George Otis Smith, director of the U. S. Geological Survey, delivered an address at a dinner given last week in Tokyo to Japanese engineers, by the American delegates to the World Engineering Congress.

John L. Herber recently became associated with the International Cement Corporation at Philadelphia, Pa., in a managerial capacity. At the time of his appointment he was Pittsburgh division engineer of the Pennsylvania Highway Department.

W. K. Moore, Ponca City, Ark., is president of the Silver Lime and Stucco Company, recently organized. **C. C. Stallings** is vice-president and manager.

J. H. Watters recently resigned as vice president of the New York Air Brake Company to accept the presidency of the Marion Steam Shovel Company. Mr. Watters was also elected a director along with Matthew C. Brush and Morgan J. O'Brien, Jr.

Frederick Wagner Stark, director of the Hercules Powder Company, died recently at his home in Wilkes-Barre, Pa., of heart disease following several months' illness. He was widely known in business and financial circles and had many club affiliations.

Mr. Stark was born at Montrose, Pa., April 30, 1870, and received his education at Wilkes-Barre. His connection with the explosives industry began in 1895 when he entered the employ of the American Forcite Powder Company. From 1904 to 1912 he was district manager for the du Pont company at Hazleton. In 1912 he joined the Hercules Powder Company, and was, until a few years ago, manager of the Hazleton office. He is survived by his wife, a daughter and a son.

Henry Aylett Coles, Atlanta district manager of the Westinghouse Electric and Manufacturing Company since 1914, died recently in New Orleans, La., of heart failure. He was a veteran in the Westinghouse service, having joined the company while its plant was located in Garrison Alley, Pittsburgh.

Mr. Coles was born in Tallwood, Albemarle County, Va., August 17, 1870. His education consisted of private instruction and one year at Roanoke College, followed by a three-year engineering course at the University of Virginia.

INSURANCE PROBLEMS DISCUSSED

Future of the Sole Proprietorship

However scientific and efficient it may be to operate under the organization of a corporation or a partnership, a large percentage of the producers in our field are sole proprietors. That is, their business is simply a plant owned outright by one man, and usually managed by the owner. Whether they like to work alone or not, they have to of necessity, either because their business is too small to support more than one executive or because they have never found a competent associate.

As long as he is on the job, a sole proprietor has a pleasant situation. He can run his business any way he wants to, he can follow his own opinion as to whether to spend all the profits or re-invest them in new machinery, and he does not have to argue a partner into agreeing with him on every move.

The disadvantage of a sole proprietorship shows up when the owner leaves the job. This can be seen in a small way around vacation time. Many a producer sticks to his office month in and month out or postpones his dreams of travel and recreation just because there is no one else who can run his business for more than a few days at a time. And this problem of "getting the business to run itself" during vacations is just a small inkling of the trouble ahead when the owner dies.

Value of Business

The premature death of a sole proprietor is a tragedy not only to his family but to the whole world. The business is ordinarily the biggest item in his estate, and his family needs to collect the full value of it in order to maintain their living. And certainly the world does not want a business to fail on account of one man's death, for failure means breaking the trade habits of customers and employes and junking valuable machinery, which is a pure economic loss that profits no one.

But, unfortunately, when the proprietor of a one-man business dies there is no available successor of equal caliber and experience. The widow, or a nephew or brother-in-law, may step in and try to keep the plant going, but unless they are trained in this particular line the business will probably lose money. Most sole proprietorships are sold out for about twenty cents on the dollar within a few months of the owner's death.

Train Successor

The ideal way to provide for the future continuation of your business is to train your own successor. Pick out a man several years younger than yourself—one of your most ambitious employes preferably, but if none of them will fill the bill find a young man with the necessary intelligence and energy in some other line. After he has mastered the routine part of your operations trust him with enough responsibility so that when you have to leave town the plant will "carry on" smoothly. After this man has made himself a full lieutenant in your organization he is the one that should take over the management after your death because he alone has the knowledge necessary to operate your particular business profitably without you.

Finding the right man is the hardest part of the job, but another factor is also necessary if you intend to save your business from the sheriff's hammer at your death and leave your wife and children the full value in your estate. You must arrange for the transfer of the ownership from your estate to your successor while you are still "in harness" yourself. If you just have a trained successor with no agreed plan of transfer, many things may interfere with protecting the interests of your family. The successor may see that he has everything in his own control and may force your estate to accept only a small payment for your rights. Or he may figure it is cheaper to resign and start up a new concern of his own than to buy out a going business. Or, with the best heart in the world, he may simply not have any money to pay your estate, and both he and your family may lose out entirely.

Contract of Sale

After deciding on the man you want to succeed to your business, you should go to him and tell him frankly that you want to offer him the opportunity to own your business after your death. This will give a faithful employe a guarantee of his own future and will give him the greatest possible incentive to work for you loyally. You then draw up an agreement with him stating that on your death he is to become the owner of the business and is to pay your estate a definite price (usually equal to the book value of the business at the time of death). The agreement can be terminated by either party on giving reasonable notice to the other, because through this provision you are both free to change or cancel the agreement if conditions change in the future.

Raising Funds

The essential element of the agreement is the raising of funds to pay your estate. It is unlikely that any employee will have money enough to buy out your business. Therefore you take out an insurance policy on your life, with your estate named as the beneficiary, and the employee pays the premiums. In case of your death your family gets the insurance money and the transaction is completed; in case the contract is terminated before death the employee is entitled to the cash surrender value of the policy in return for the premiums he has paid in.

If you have no employee who would be capable of carrying on your business alone, you may be able to find a friendly competitor in neighboring territory, or a man in some related line, who could operate your plant profitably and who would be interested in a provisional contract of sale of this sort.

Cash Reserve Needed

Regardless of whether your business is to be sold out at once or not, some cash should be available for business purposes immediately after your death. There is an incredible pinch for ready money when the owner of a one-man business dies. All the customers become a little lax in their payment of accounts receivable, while the creditors all tighten up—payrolls have to be met in cash, and the machinery and supply dealers shorten up on their credit terms until they see how your estate is going to pull through. I have seen one-man businesses thrown into bankruptcy by death where there was no question as to the ultimate soundness, simply because the creditors got panicky over the temporary shortness of ready cash. Think how different the situation of your family would be if, in addition to any personal insurance which you may have, you should take out a policy for the benefit of your estate equal in amount to, let us say, your entire overhead expense and pay roll for six months (this period will about cover the duration of the usual pinch for money). On your death the executor of your estate can go to your banker and say something like this:

"Mr. Smith, you know John Brown left a good business and I have the job of protecting his family in disposing of it. Besides the business he left $10,000 in a special life insurance fund. I want to put this money in your bank under joint control so that both you and I have to sign any check drawn against it. Then I want you to write a letter to all the firms he buys supplies from telling them that the money has been put in your hands for their protection and you want them to extend their help in carrying on the business." Such an arrangement would be received enthusiastically by the banker and your creditors alike, and would give your executor a "breathing spell" so that he could reorganize the business under favorable conditions with no fear of a forced sale.

RECENT PATENTS

PIT AND QUARRY *will furnish, at its actual cost, a copy of any patent cited below. A charge of ten cents per copy is made by the U. S. Patent Office, Washington, D. C., and readers may procure a copy directly by addressing the Commissioner of Patents, with payment for copies requested. Postage stamps are not accepted by the Patent office. We will endeavor to obtain copies of foreign patents for our readers but we cannot give assurance in every case for the reason that copies of such patents are not printed for distribution as liberally as are the American copies, nor is there a fixed charge per copy.*

American

Apparatus for treating wet raw materials in the manufacture of cement. Johan S. Fasting, Valby, Denmark. American 1,731,457.

Dual-feed pulverizing apparatus. Fred H. Daniels, Worcester, Mass. Assignor to Riley Stoker Corp. Same place. American 1,731,649.

Riffle. George A. Harris, Garfield County, Colo. American 1,731,660.

Dipper-dumping control for shovels. Erich H. Lichtenberg and Harold E. Brey, Milwaukee, Wis. Assignor to Koehring Co. Same place. American 1,731,673.

Boom-bucket-control mechanism for concrete-distributing apparatus. George E. Webb, Milwaukee, Wis. Assignor to Koehring Co. Same place. American 1,731,691.

Method for proportioning total water in concrete. Charles S. Johnson, Champaign, Ill. American 1,731,781.

Grinding-mill. Charles E. Needham, Allentown, Pa. Assignor to Bethlehem Foundry & Machine Co. American 1,731,788.

Pulverizing-machine. Michael Wagner, Pittsburgh, Pa. Assignor of one-half to McCallum Co. Same place. American 1,731,956.

Load suspension and hoisting mechanism (for power shovels). James Reaney, Baltimore, Md. American 1,731,984.

Combined power hammer and shovel mechanism. James Reaney, Baltimore, Md. American 1,731,985.

Automatic skip-controlling mechanism. Charles H. Wagner, Washington, D. C. Assignor to Koehring Co., Milwaukee, Wis. American 1,732,198.

Bucket and boom conveying and distributing mechanism. Samuel Shafer, Jr., Milwaukee, Wis. Assignor to Chain Belt Co. Same place. American 1,732,207.

Quick-setting lime product and method of making same. Chauncey C. Loomis, Yonkers, and Alexander D. MacDonald, Hastings-on-Hudson, N. Y. Assignors to Colloidal Lime Plaster Corp., New York, N. Y. American 1,732,409.

End disk for hammer mills. James E. Stine, Aldan, Pa. Assignor to Pennsylvania Crusher Co., New York, N. Y. American 1,732,701.

Plaster and process of controlling the setting and expansion of setting, an accelerator and expansion controller therefor, and process of making such controllers. John D. Wiggin, Montclair, and Mathias M. Remmes, Belleville, N. J. Assignors to H. B. Wiggin's Sons Co., Bloomfield, N. J. American 1,732,737.

Holding-block for scraper excavating-buckets. Ole T. Martinson, Chicago, Ill., and Oscar J. Martinson, River Forest, Ill. American 1,732,942.

Method of proportioning aggregates and water for concrete. Charles S. Johnson, Champaign, Ill. American 1,733,410.

Pulverizing-mill. Ernst C. Loesche, Berlin-Lankwitz, Germany. American 1,733,417.

Excavator. Charles H. Ruth, Walnut Park, Calif. Assignor to Ruth Dredger Mfg. Co., Huntington Park, Calif. American 1,733,427.

Shear surface ring for pulverizing-machines. Russell J. Williams and Charles A. Wettengel, St. Louis, Mo. Assignors to Southern Manganese Steel Co. Same place. American 1,733,637.

Power shovel. John D. Rauch, Lima, Ohio. Assignor to Ohio Power Shovel Co. Same place. American 1,733,753.

Lime-kiln cooling attachment. Charles R. Birdsey, Hinsdale, Ill. Assignor to United States Gypsum Co., Chicago, Ill. American 1,733,857.

All-steel gravel-box. Arthur W. Randolph, Mankato, Minn. American 1,733,905.

Foreign

Impact pulverizers. J. P. Van Gelder. British 317,446.

Pit props. J. H. Bramah. British 317,146.

Scoop arm excavators. Fleming & Ferguson, Ltd. & W. S. Appleton. British 316,075.

Roller and breast mills. A. E. G. MacCallum. British 316,907.

Sorting mica flakes. L. T. Frederick. British 315,523.

Alumina from bauxite. U. B. Voisin. British 306,095.

Refractory materials. R. L. Frink. British 306,216.

Porous concrete. N. E. Broander. British 306,444.

Lime and cement containing blood serum. A. Genairon. British 306,038.

Cellular building material. G. M. Thompson. British 305,806.

Cement. L. Perrin & B. Tuscher. British 305,170.

Lining cement pipes with bituminous material. B. E. Monteux & P. L. Durand. British 304,288.

Porous concrete. G. Richter. British 305,415.

Separating mica flakes. L. T. Frederick. British 317,553.

Impact pulverizers. H. A. Livingstone. British 316,992.

Grinding mills. J. Y. Johnson. British 317,208.

Cement guns. Woodall-Duckham Ltd. and A. M. Duckham. British 317,595.

Gas shaft kiln for burning or roasting lime, dolomite, magnesite, etc. W. Müller. German 482,111.

Clinker cooler for rotary kilns. Klockner Werke A. G. German 482,-356.

Process for the production of aluminous cement. U. B. Voisin. German 482,185.

Grinding machine. M. Konig. German 476,526.

Drum mill for wet grinding. Fried. Krupp Grusonwerke A. G. German 477,135.

Machine for production of hollow concrete blocks. R. Gasterstädt. German 480,741.

Drying process. M. Hirsch. German 478,324.

Polishing surfaces, especially building walls. Leipziger Tangier-Manier Alex. Grube A. G. German 478,224.

Alumina. Elektrizitätswerk Lonza. Swiss 131,590.

Cement. Perrin & Tuscher. Swiss 129,818.

Method of impregnating cement blocks with coal tar or pitch by pressure. "Diana" Bau u. Isolier Platten A. G. Swiss 131,761.

Apparatus for aerating wet cement. G. B. Hinton. Swiss 131,757.

FINANCIAL NEWS
CORPORATE & BUSINESS

The information contained in these financial pages is given with the understanding that any statement on the part of this magazine or any of its staff, as to the responsibility or standing of any person, firm or corporation, or as to the value of any property or securities is a mere expression of opinion, given as a matter of service to the readers of PIT AND QUARRY, *for which no responsibility in any way is to attach to this magazine or to any of its staff.*

Stock Market Debacle May Have Favorable Effect on Some Industries

While considerable apprehension still prevails in certain quarters as to the ultimate effect of the three-weeks' market collapse, still there are industries and corporations that look for definite strengthening in their status.

Cement companies were just beginning to feel severely the hardships and unsatisfactory conditions that have been developing this year and there is considerable uncertainty over maintenance of persent dividend rates by at least two of the larger companies. A tapering off of building activity and road construction early this year, foreign competition (especially Belgian importations), over-expansion, and over-production, and a series of price reductions have affected profits in spite of the fact that several companies are reporting increasing sales.

Alpha Portland Cement, which was recently listed on the New York Stock Exchange, showed earnings of $2.60 a share on the 711,000 shares of common stock for the 12 months ended September 30, a sharp decline from the previous year. Dividend payments are made on the common stock at the rate of $3 annually and it is doubtful if the company can show earnings sufficient to cover the dividend for the year ending December 31. Because of this probability a reduction in the present dividend rate is expected. The company is in good financial condition with cash and its equivalent on September 30 amounting to nearly $7,000,000. The ratio of current assets to current liabilities was better than seven to one.

Foreign competition and price reductions along the Atlantic seaboard have been particularly severe on the Penn-Dixie Cement Company, as 40 per cent of its producing capacity is in the territory affected by these unsatisfactory conditions. For the twelve months ended September 30, net earnings amounted to $686,000, equal to $5.05 a share on the 135,888 shares of preferred stock with dividend requirements of $7 annually. Dividend action is due soon for the next quarterly payment and it is expected that dividends will probably be suspended at this time. By omitting the dividend the company will be able to maintain its good financial position with some $5,600,000 in cash and current assets amounting to around seven times current liabilities.

Lehigh and International Cement are the two large companies that have been least affected by the depression. Earnings per share of Lehigh, for the nine months ended September 30, amounted to $5.70 against $5.57 in the corresponding 1928 period. This company does 12 per cent of the total for the industry. Its dividend of $2.50 a share annually will be earned by a wide margin and its financial position is secure with over $12,700 in cash.

Earnings of International Cement Co. this year are expected to approximate those of 1928, when $7.90 a common share was reported. Earnings for the first nine months were slightly above those of the similar 1928 period. While price-cutting, competition, and importations forced the closing of the company's new Norfolk plant late this past summer, other mills are so well distributed geographically here and in South America, that curtailment in one district has less effect on operations of the entire system than might be the case if production were centered in a more restricted territory.

With prospects of tariff protection considerably dimmed by the changed legislative conditions in Washington, some officials point out that trade conditions could be substantially improved if a serious effort were made, by interests representing the various companies, to come to some agreement concerning price cutting. Any agreement reached would probably be subject to approval by official quarters in Washington.

But, notwithstanding, these past months' retarding of building activities and, consequently, of good business for the many cement, asphalt, gravel, sand and other similar concerns, and almost because of the recent stock market crash many quarters are looking for a betterment of conditions in their field.

It is looked upon as a favorable development because a release of funds from the speculative market will aid the marketing of bonds. As a consequence the funds needed for public improvements, such as roads, can be more readily provided and the closing of contracts that are now pending should be facilitated.

CURRENT DIVIDENDS

COMPANY	CLASS OF STOCK	DIVIDEND RATE	HOLDERS OF RECORD	PAYABLE
Alpha Portland Cement	Preferred	1¾% qr.	Dec. 1	Dec. 15
Atlas Portland Cement	Common	$.50 qr.	Nov. 16	Dec. 3
American Brick Co.	Preferred	$.50 qr.	Oct. 25	Nov. 1
Bessemer Limestone and Cement	Class A	$.75 qr.	Oct. 20	Nov. 1
Bloomington Limestone Co.	Common	$.07½ qr.	.....	Nov. 1
Bloomington Limestone Co.	Preferred	1¾% qr.	.....	Nov. 1
Canada Paving and Supply	1st Pfd.	1¾% qr.	Nov. 15	Dec. 1
Cleveland Stone Quarries	Common	$.75 qr.	Nov. 15	Dec. 1
Cleveland Stone Quarries	Common	$.25 extra	Nov. 15	Dec. 1
Consolidated Sand and Gravel	Preferred	1¾% qr.	Oct. 31	Nov. 15
Construction Materials	Preferred	$.87½ qr.	Oct. 19	Nov. 1
General Asphalt	Preferred	1¼% qr.	Nov. 15	Dec. 1
General Refractories Co.	Common	$.75 qr.	Nov. 12	Nov. 26
Indiana Limestone	Preferred	1¾% qr.	Nov. 20	Dec. 1
Kentucky Cons. Stone Co.	Preferred	1¾% qr.	Oct. 15	Nov. 1
Kentucky Rock Asphalt	Preferred	1¾% qr.	Nov. 15	Dec. 3
Lehigh Portland Cement	Common	$.62½ qr.	Oct. 13	Nov. 1
Material Service Corp.	.....	$.50 qr.	Nov. 15	Dec. 1
Metropolitan Paving Brick	Common	$.50 qr.	Nov. 15	Dec. 1
Missouri Portland Cement	.....	$.50 qr.	Oct. 19	Nov. 1
Pacific Clay Products	.....	$.60 qr.	Oct. 20	Nov. 1
Riverside Cement	1st Pfd.	$1.50 qr.	Oct. 15	Nov. 1
Riverside Cement	Class A	$.31¼ qr.	Oct. 15	Nov. 1
Standard Paving Materials, Ltd.	7% Pfd.	1¾% qr.	Nov. 2	Nov. 15
Standard Paving Materials, Ltd.	Common	$.50 qr.	Nov. 2	Nov. 15
Superior Portland Cement	Class A	$.27½ M	Oct. 23	Nov. 1
Virginia Carolina Chemical	Pr'r Pfd.	1¾% qr.	Nov. 17	Dec. 1
Worcester Salt Co.	Preferred	1½% qr.	Nov. 10	Nov. 15
Wolverine Portland Cement	.....	$.15 qr.	Nov. 5	Nov. 15

John Dearborn, president of Warren Brothers, the paving enterprise, states that it has been their experience in the past that, even during extreme depression periods, the business of the company has expanded as a result of public work contracted to alleviate the effects of a business letdown. Warren Brothers reports a large number of contracts being held in abeyance.

According to the Alexander Hamilton Institute, the building industry can expect a betterment as a result of the anticipated easing in money rates. Before many months a flow of mortgage money should become available to afford the building industry a marked stimulant. On the basis of past experience this commentator looks for a cessation in the decline of building activity within a few months, and the start of a recovery from the current low level to a possible peak in 1931.

Construction Materials Corporation

President Sensibar in a recent letter to stockholders of this company states that from present indications, earnings of Construction Materials Corporation in 1929 should be at least as good as the record figure of $1,005,579 established in 1928. At present the corporation has on hand in the sand-fill department more orders than it has ever had before and enough to keep its present equipment fully occupied for the year 1930. The volume of the gravel and sand division for 1930 is approximately twice that of any previous year. The company's street-paving subsidiary has completed and now has under contract a volume of business slightly in excess of any year heretofore.

General Refractories Company

This company which manufactures and sells refractory or fire brick, including clay silica and magnesite brick, and owning or having under lease fire clay and ganister properties totalling many thousands of acres, has published a financial statement as of September 30, 1929. The company owns surface and mineral rights to 8,482 acres in Blair, Bedford, Clearfield, Centre, Clinton, Huntington, Cameron, Potter, and York counties in Pennsylvania, and has holdings in Carter and Rowan counties in Kentucky.

All the mineral acreage has been proved by actual mining or quarrying operations or by diamond drills, and assures ample supplies of raw materials.

General Refractories has no funded debt and the balance sheet, as of September 30, 1929, compares as follows:

Assets

	Sept. 30, 1929	Dec. 31, 1928
*Property, equip., mineral lands, etc.	$15,211,738	$15,119,411
Cash	1,002,568	149,866
Bills receivable	60,765	1,407,383
Accounts receivable	1,519,585	.....
Inventories	2,735,214	2,703,089
Accrued interest	42,021	1,652
Emp. mortgages	1,389	2,539
Investments	978,143	811,747
Deferred accounts	426,426	650,815
Patents	33,519	32,966
Depos. with trustees	.....	62
Total	$22,011,368	$20,879,630

Liabilities

Accounts payable	$ 156,892	$ 500,704
Accrued accounts	197,463	256,389
Dividends payable	.....	168,750
Federal income taxes	161,296	111,330
Unclaimed dividends	372	.....
Bonded debt	.....	3,608,000
Capital stock and surplus	†21,495,405	16,234,457
Total	$22,011,368	$20,879,630

* After depreciation and depletion.
† Represented by 300,000 no-par shares.

Directors of the company have just declared an extra dividend of 25 cents a share in addition to a quarterly dividend of $1, both of which will be paid November 24, to those of record November 11. This places the stock on a $4 annual basis as compared with $3 previously paid. Three months ago a quarterly dividend of 75 cents was supplemented by an extra of 50 cents.

Justification for this more liberal treatment of stockholders is given by earnings' figures for the first nine months of the fiscal year, which are presented below.

Nine Months Ended Sept. 30	1929	1928
Net after taxes, deprec., etc.		
March quarter	$ 591,744	$ 216,289
June quarter	652,654	289,010
Sept. quarter	657,082	383,888
Nine months	$ 1,901,480	$ 889,187
Earned per share (300,000 shares)	$6.33	$2.96

Atlas Portland Cement

Atlas Portland Cement Company has completed the purchase of a substantial area of ground in the vicinity of Havana, Cuba, upon which it is considering the erection of a plant.

It is understood that if this output is successfully placed, the company will consider the erection of a plant on the other side of the island.

There is already an American-owned portland cement plant on the island, but some distance from Havana, and the Atlas company feels that the future of Cuba justifies the contemplated construction, especially with such facilities as it will be able to offer because of its proximity to consumption.

German Cement Concerns Unite

According to the Berlin correspondent of the London *Financial Times*, four German companies, controlling fifty per cent of the country's portland cement production have agreed to combine. The merger, it was announced, is entirely independent of the Cement Syndicate. All the companies are prosperous and have modern plants.

"The directors of the new combine," says that newspaper, "announce that their contract is absolutely independent of the German Cement Syndicate.

"It seems very probable that the intention of the firms concerned is to have a solid organization ready in case the syndicate is dissolved, as is confidently expected. The firms which have signed the new agreement are: Dyckerhoff and Sons' Portland Cement Factory at Mayence; E. Schwenk Cement and Stone Works at Ulm, on the Danube; the Heidelberg and Manheim Portland Cement Works in Heidelberg; and the Silesian Portland Cement Industry Co. in Oppern. The firms named control over half of the total German production of portland cement.

"The Silesian Portland Cement Co. has a capital of 27,000,000 marks and has paid a dividend of 12 per cent for each of the past two years. The Heidelberg Portland Cement Works has a capital of 30,000,000 marks and has paid 10 per cent in dividends for 1927 and 1928. The other two companies are similarly prosperous.

"The German Cement Syndicate is practically in process of dissolution, as its chief member, the Wicking group, is tired of contributing to the cost of fighting outsiders, and considers that, with its thoroughly rationalized works, it can crush outsiders better than if it were bound up with the syndicate. The Wicking group is not on too good terms with the new amalgamation.

"It is known that the companies comprised in the new combine are as efficiently rationalized as the works of the Wicking concern, and that their plant is very modern. It is announced that a foreign financial group, believed to be American, has arranged to establish Portland cement works in Germany and also in some unnamed adjoining country, which will be equipped with the most modern plant."

Raybestos-Manhattan, Inc.

The following statement shows, by quarters the earnings of Raybestos-Manhattan, Inc., a recent consolidation of the Raybestos Company, the United States Asbestos Company and the Manhattan Rubber Company. Unfortunately, no comparison is available, although in the first six months of 1928, aggregate net income of the three companies is reported to have equalled about $1,200,000. In the full year of 1928 combined net profit amounted to $2,465,585, and to $1,106,969 in 1926. Sales in the nine-months' period shown below are estimated around $18,500,000.

Nine months ended Sept. 30, 1929. Net after charges and taxes, (approximately)

March quarter	$ 947,530
June quarter	1,151,000
September quarter	1,300,000
Nine months	$3,398,530
Earned per share (677,012 shares)	$5.02

Apparently earnings are running at a rate materially ahead of 1928. Good progress from quarter to quarter is also shown. The company has estimated earnings for the full year around $4,700,000, or about $7 per share, indicating the expectation of a last quarter at least equal to the September period.

The last balance sheet, one dated June 30 last, showed current assets of $10,870,956 which included cash of $3,203,500, as against current liabilities of only $1,427,000, resulting in net current assets in excess of $9,400,000.

The company has outstanding only 677,012 shares of common stock. At present this common stock pays no dividends, although an initial declaration is expected in the near future at an annual rate in the neighborhood of $3 a share.

The Pacific Coast Company

This large company is empowered to mine and sell minerals and to operate other similar enterprises in Washington, Oregon, California and Alaska. It owns 5,500 shares of the outstanding preferred stock and 70,500 shares of the 100,000 outstanding common stock of the Pacific Coast Cement Company. This latter company constructed a cement plant with an annual capacity of 1,000,000 barrels in Seattle last year.

The company has just reported briefly as follows for the first nine months of 1929 and for 1928.

Nine Months Ended Sept. 30

	1929	1928
Gross	$3,668,363	$3,048,653
Net after expenses		
March quarter	163,662	41,657
June quarter	51,580	*61,073
Sept. quarter	10,220	30,359
Nine months	$ 225,462	$ 10,943

* Loss.

Due largely to a good first quarter, earnings continue to make a satisfactory comparison with 1928, although September operations do not appear to have yielded a very great net income.

The exact importance of the company's cement interests is not known in its relation to income, but the poor general conditions in that industry which have prevailed over the past few months may account for the smaller results reported last quarter.

All the company's stock is outstanding in moderate amounts, and any general upward trend in income over a sustained period would result in reasonably large per-share earnings.

New Corporations

Boulder Canyon Gypsum Corp., Kingman, Ariz. $500,000.

Dicalite Co., c/o U. S. Corp. Co., Dover, Del. 10,000 shares com. Gypsum, lime, cement.

Arkansas-Missouri Gravel Co., Gilbert C. Hill, Bloomfield, Mo. $70,000. Geo. Layton, Bloomfield; D. D. Hill, Charleston, Mo.

Vulcan Sand & Stone Co., Arthur J. Martin, Plainville, Conn. $30,000. David F. Carton, Tuckahoe, N. Y.; Theodore M. Martin, Plainville, Conn.

Gaston Granite Co., H. L. Rutter, Gastonia, N. C. $100,000. H. Rutter, G. R. Dixon.

Coming Events

Nov. 20-23, 1929. Fort Worth, Tex. Annual convention, International City Managers' Association.

Dec. 2-4, 1929. Asheville, N. C. Winter meeting, American Institute of Chemical Engineers.

Dec. 2-7, 1929. New York, N. Y. National Exposition of Power and Mechanical Engineering at the Grand Central Palace. International Exposition Company, New York, N. Y. Mr. Roth, secretary.

Dec. 4-6, 1929. Chicago. Annual meeting, National Paving Brick Manufacturers' Association, at the Palmer House. W. C. Schlesinger, secretary, National Press Bldg., Washington, D. C.

Dec. 6, 1929. Indianapolis, Ind. Meeting, Indiana Sand and Gravel Association at Claypool Hotel. S. C. Hadden, executive-secretary, 603 Occidental Bldg., Indianapolis.

Dec. 10-31, 1929. Santiago, Chile. International Railroad and Road Exposition. Secretary, San Martin 352, Santiago, Chile.

Dec. 12, 1929. Pittsburgh, Pa. Meeting, Steel Founders' Society of America. G. P. Rogers, managing director, 932 Graybar Bldg., New York, N. Y.

Dec. 12-13, 1929. Washington, D. C. Annual meeting, Highway Research Board, at the National Academy of Science and National Research Council.

Jan. 11-18, 1930. Atlantic City, N. J. Annual convention and show, American Road Builders' Association. E. A. Birchland, secretary, 37 W. 39th St., New York, N. Y.

Jan. 20-23, 1930. Cincinnati, O. Annual convention and Manufacturers' Division Exposition, National Crushed-Stone Association, at Hotel Gibson. J. R. Boyd, secretary, Merchandise Bldg., 14th and S Sts., N. W., Washington, D. C.

Jan. 28-30, 1930. Memphis, Tenn. Annual convention and Manufacturers' Division Exposition, National Sand & Gravel Association, at the Peabody Hotel. V. P. Ahearn, executive secretary, Munsey Bldg., Washington, D. C.

Jan. 29-30, 1930. Milwaukee, Wis. Annual convention, Wisconsin Concrete Products Association, at Hotel Plankinton.

Feb. 11-13, 1930. New Orleans, La. Annual meeting, American Concrete Institute, at the Roosevelt Hotel.

Feb. 16-20, 1930. Toronto, Can. Thirty-second annual meeting, American Ceramic Society at Hotel Royal York. Gordon C. Keith, secretary-treasurer, 49 Turner Road, Toronto 10, Canada.

Feb. 25-28, 1930. Wichita, Kan. Fifth annual Southwest Road Show and School at the Coliseum. Secretary, P. O. Box 1043, Wichita, Kan.

Mar. 3-7, 1930. Chicago. National Industrial Exposition at the Stevens Hotel. George Pfisterer, secretary, 308 W. Randolph St., Chicago.

Apr. 5-9, 1930. New York, N. Y.; Hoboken, N. J.; Washington, D. C. Fiftieth anniversary meeting, American Society of Mechanical Engineers, at American Machinist offices in New York; Stevens Institute, Hoboken; U. S. Chamber of Commerce Bldg., Washington.

April 7-11, 1930. Atlanta, Ga. Annual meeting, American Chemical Society.

May 12, 1930. Cleveland, O. Meeting, Steel Founders' Society of America. G. P. Rogers, managing director, 932 Graybar Bldg., New York, N. Y.

June 16-25, 1930. Berlin, Germany. World Power Conference. World Power Conference Program Committee, Room 818, 29 W. 39th St., New York, N. Y.

LEGAL INFORMATION FOR OPERATORS

Employees Bound to Realize Danger

Generally speaking, an employer is bound to furnish employees a reasonably safe place in which to work. Also, a foreman is bound to warn the employees of any *unknown* hazards. If, however, the workmen should by *the application of ordinary care* realize the dangers associated with the employment, the employer is not liable.

For instance, in Portland Cement Co. v. Taylor, 18 S. W. (2d) 904, a foreman directed his employees to stack material which later fell upon one of the workmen. The latter's dependents sued the employer to recover damages on the grounds that the foreman was negligent in failing to warn the employee of the danger in stacking the material at the great height. However, the court held the employer not liable, saying:

"It is our opinion that the labor to be performed was so simple and the danger attending it was so obvious that liability cannot be predicated upon the failure to warn and instruct the employee."

Mechanic's Lien Dates from Time First Material Is Furnished

In almost all litigations, the higher courts have held that the right of a material man to a mechanic's lien dates from the day the first material was furnished the owner, or his authorized representative. This is true although a woman owner of property authorized her husband to purchase material for her.

For example, in J. H. Magill Co. v. Carter, 17 S. W. (2d) 581, it was disclosed that a woman owned a lot and her husband named Carter purchased cement on February 16th which later was used in constructing a building on the lot. Litigation developed between the seller of the cement and another seller who sold material to the woman *after* February 16th.

In holding the cement seller entitled to a lien, the court said:

"The first delivery of material by the cement company was February 16th, and, as affecting the lien, the status of the parties must be determined as of that date. . . . If, therefore, George Carter was acting as her agent when he made the first purchase of material on February 16th . . . then the material sold to George Carter by the cement company was also sold to her."

Lease Contract Relieving Common Carrier From Damages Is Valid

While it is true that a railroad company may not make valid contracts by which it is relieved from liability for loss of injury to goods being transported, yet a lease contract is valid by the terms of which it is relieved from liability for injury to goods stored on its own property or right-of-way.

For illustration, in Southern Ry. Co. v. Stearns Bros., 28 F. (2d) 560, it was disclosed that certain machinery, as cement mixers, which was damaged, had been placed on the right-of-way of a railroad under a leased contract which provided that the goods were stored at the risk of the owner and that the former should be exempted from liability for damage, whether the same should result from the negligence of its employees or otherwise.

While cars were being shifted the engineer negligently "kicked" two of the cars with such great force that they left the track and damaged the stored property.

The owner of the mixers filed suit contending that a railroad company may not legally contract against the negligence of its engineer. However, the court held the company not liable, saying:

"It is well settled that a railroad company cannot contract against liability for its negligence with respect to the performance of its duty as a common carrier. This rule has no application, however, to contracts by which it leases portions of its right-of-way for uses not connected with the discharge of its duty as such carrier. The public has no interest in such contracts, and a provision that the railroad is not to be held liable for negligence resulting in damage to property placed upon the leased premises is not void as being contrary to public policy."

Extension of Time for Payment Relieves Surety's Liability

The law is well established that a surety is automatically released from liability on a bond if any creditor extends the time for payment without consent of the surety. Therefore, acceptance by a contractor of a note from an owner usually relieves the surety of liability.

In Hammond Co. v. Richardson Building & Engineering Co., 278 Pac. 261, a contractor furnished a usual bond. After completion of the building he owed $23,192 for stone used in the construction work. Without permission of the contractor's surety the creditor accepted in lieu of the debt, which was due, the contractor's note payable in 90 days. This note contained the following provision:

"This note is not given or accepted as payment of said amount due said payee, but as evidence of said debt as a stated account only, and neither the giving or accepting of this note, with or without security, shall be held to waive payee's right to enforce any mechanic's lien or other lien, to which it would otherwise be entitled."

When the contractor failed to pay the note the creditor filed legal proceedings against the surety, who contended that it was automatically relieved from obligations on the bond when the creditor extended the time of payment by accepting a note payable in 90 days.

The creditor contended that the above provision in the note resulted in the surety's liability being unchanged. However, the court held the surety not liable, saying:

"Whatever may be the effect of this provision, it in no manner affects the other provision of the note which fixed the time of payment of the indebtedness *then due* at 90 days after the date of the note. Appellant seems to concede that it is the general rule that where the creditor grants the debtor an extension of time without the consent of the surety, the latter is released; but it contends that this rule 'has no application to a bond that is given for the payment of labor and materials,' . . . the laborer or material man is the creditor, and it is not he, but the owner, who has extended the time. But in this case the creditor, the one furnishing the materials, extended the time, and no reason appears for not applying the general rule."

Uncancelled Notes Held Valid

Generally speaking, the courts strictly interpret a written contract and will consider only the contents of the instrument in deciding legal controversies.

For instance, in Siler v. Colosimo, 166 N. E. 667, it was disclosed that a person purchased cement machinery and executed a series of notes in payment thereof. Later the purchaser became dissatisfied with the machinery and resold it to the first owner under a written contract in which the notes were not mentioned. Litigation developed over the legality of these notes, and in holding the notes valid, the court said:

"The notes are not mentioned in the written contract, and, according to the well established rule of written instruments, that which is not in the instrument was intended to be left out."

Cement Block Plant Held a Nuisance

It is well established that where the facts show that any lawful business is being or shall be conducted in such a manner as to constitute a nuisance, causing substantial injury to the comfort, health, or property of others, a court is authorized in enjoining and abating such nuisance. Sometimes the court's injunction is limited, *not to the business itself*, but to the method of its conduction that creates the nuisance, leaving the right to the owner to carry on the business in a proper and lawful manner.

However, where it clearly appears that such business cannot be conducted in any manner at the place where situated, without constituting a substantial injury to adjoining property owners, the injunction absolutely prohibits the operation of such business.

For illustration, in Muskegon Co. v. Bousma, 225 N. W. 611, a cement block manufacturer purchased lots 26 and 27 in a subdivision which was restricted to residents. However, by mistake the deeds of these lots did not contain the usual restrictions. Certain property owners offered a large amount of money to the cement manufacturer if he would not build his plant on the lots. However, he refused the offer. Later the adjoining property owners instituted legal proceedings to stop operation of the plant on the contention that the noise and dirt created thereby resulted in its being a legal nuisance. Since the plant was built adjoining the residences, the court granted an injunction against its operation, saying:

"Restrictions which are not a matter of record and of which a party has neither actual nor constructive notice cannot be enforced against such party. . . . We are satisfied by the proof that, before he signed this contract to purchase, he (cement manufacturer) knew that it was claimed that the lots in this block were to be used for residential purposes exclusively, and that those owning the property were objecting to his carrying on his manufacturing business on these lots . . . he must have known that there were no other industrial plants in this neighborhood . . . After a careful consideration of this record, we are of the opinion that these plaintiffs are entitled to a decree enjoining the defendant from carrying on the business of manufacturing cement blocks on lots 26 and 27 of block 4 in the manner heretofore employed by him."

Contractor Liable for Improper Use of Cement

It is important to know that in many instances contractors have been held liable for defective structures, although the owner originally attempts to hold the seller of the material liable.

For example, in Leinhard v. Meyer, 123 So. 130, it was disclosed that a man named Meyer acted as architect and contractor in the construction of a stucco coated apartment building. After the building was completed and Meyer had received full payment in accordance with the contract, the owner discovered that the side walls of the building leaked water. The contractor contended that the leaks were caused because the stucco, cement and other materials were defective. However, it is interesting to observe that the court held the leaks resulted from defective workmanship, and said:

"Plaintiff (owner) proved by a preponderance of evidence that the leaks in the walls and around the windows were caused by the contractor's failure to place mortar and cement in the cross joints of the tile, and to the improper application of the stucco to the outside of the hollow tile. . . . The leaks around the windows and in the walls were primarily caused by the contractor's failure to apply a proper coat of stucco to the outer walls. The thin coat of stucco permitted the rain to seep through, and, there being no cement or mortar in the cross joints of the tile, the water came in contact with the plastering on the walls and around the windows and leaked down upon the floors, causing the damages complained of. It was the intention of all the parties to the contract that the building should be tenantable and constructed in a workmanlike manner, and of good material such as to resist the usual rains in the locality. The building was not waterproof, as was contemplated by the contract."

Physician's Testimony Not Important

Generally speaking, a physician's testimony regarding an injury is taken as important evidence by the court only when it appears to be correct and dependable in consideration of the extent of the injury.

For illustration, in Indiana Limestone Co. v. Ridge, 167 N. E. 617, a workman for a limestone company sustained an injury to his foot. The physician who treated the injury testified that all of the toes and a part of the foot were amputated, the amputation being back of the ball of the great toe, and that the degree of impairment of the foot was from 33 1/3 to 35 per cent. The physician testified that he was a practicing physician, but was *not* asked the usual questions put to a physician to qualify him *as an expert* witness.

The injured employe, as a witness in his own behalf, appeared before the Industrial Board and described his injuries, and then stated that the degree of impairment of the foot was 75 per cent. In view of this testimony the Industrial Board allowed him compensation based on 75 per cent impairment of the foot. The limestone company appealed to the higher court contending that the physician's testimony that the impairment was from 33 1/3 to 35 per cent should be used as a basis for determining the amount of compensation. However, the court upheld the allowance of the Industrial Board, saying:

"We cannot say that there is no evidence to support the finding that there was a 75 per cent impairment of appellee's foot. There is competent evidence to sustain the award."

When Approval By Architect Is Legal

Generally speaking, an architect, who had proper authority and in good faith approved material, cannot later reverse his approval. Moreover, this is true although the contract and specifications provide that the architect's decision is binding on all parties.

For instance, in Granette Products Co. v. Arthur H. Neumann & Co., 221 N. W. 197, it was disclosed that a contractor, who obtained a contract to construct a building, made a contract with a subcontractor. The latter agreed to furnish stone, known as granette. The contract between the contractor and subcontractor contained the following clause:

"The subcontractor agrees to furnish all labor and materials necessary to complete work as described in section II. . . . The subcontractor agrees that the material to be furnished and work to be done by him is as follows: All of the granette concrete architectural stone trim, including all sills, steps, etc., in lieu of Bedford stone as mentioned and called for in revised plans and specifications as prepared by the above mentioned architects. . . . All of the above mentioned work to be subject to the approval of the above mentioned architects."

The plans and specifications also contained this further provision:

"The decision of the architects as to the true intent and meaning of the plans and specifications shall be final and binding upon both parties to the contract."

The architect came to the subcontractor's plant and inspected all of the granette prior to the same being loaded on the car for shipment. A test of the granette material was made by the architect after a *portion* of it had been delivered and he expressed satisfaction at the test made. However, when the architect inspected the material at the job he disapproved it and immediately notified the principal contractor that all of the material furnished by the subcontractor was defective and ordered its removal from the building and grounds.

The subcontractor sued the principal contractor for damages equal to the profit he would have earned had the granette been accepted and laid in accordance with the terms of the contract. The subcontractor contended that the architect had approved the material furnished by him, and having once approved the same, he had no legal right thereafter to reject it.

The court carefully reviewed all of the evidence and held the principal contractor liable to the subcontractor for the profits the latter would have earned had the granette been accepted, saying:

"We assume . . . that the subcontractor was bound, not only by the terms and provisions of the contract between the subcontractor and the principal contractor, but also by the plans and specifications for the construction of said building, and likewise by the terms and provisions of the principal contract between the principal contractor and the school district. . . . When the arbitrator or referee has made, or, as it is said in some cases, has made and published, his award or report, as a completed instrument, his power is wholly at an end. He has exhausted his authority. . . . It would be a harsh and unreasonable construction to place upon such a contract to hold that under it the architect could accept all of the material furnished by appellee (subcontractor) and thereafter summarily reject it and by so doing, absolve appellant (principal contractor) from liability to subcontractor to pay for the material furnished. Such is not the law."

MANUFACTURERS' PUBLICATIONS

Each publication listed below contains information of interest to non-metallic mineral producers. Readers may obtain, without charge—except where a price may be stated—and without obligation, copies of any of these publications by writing directly to the manufacturers who publish them. Please mention PIT AND QUARRY *when making such requests.*

Aggregates

"American Aggregates Corporation Have Excellent Plant at Logansport, Ind." 4 p. 5 ill. (*The Hercules Record*, Nov. 1929. A. Leschen & Sons Rope Co., St. Louis, Mo.) Describes and illustrates a modern aggregates plant.

Blasting Caps

"Making Hercules Caps." 3 p., 12 ill. (*The Labors of a Modern Hercules.* Hercules Powder Co., Inc., Wilmington, Del.) Describes the manufacture of regular and electric blasting caps.

Box-car Loaders

"S-A" Box-Car Loader. 2 p., 4 ill. (Stephens-Adamson Mfg. Co., Aurora, Ill.) Describes and illustrates a two-wheeled Sinden-type box-car loader.

Diesel Engines

"Diesel Power vs. Gasoline Power." 2 p., 10 ill. (*The P & H Crowd*, Nov.-Dec., 1929. Harnischfeger Corp., Milwaukee, Wis.) Points out the differences between gas and diesel engines.

Dynamite

"The Ingredients and Manufacture of Dynamite and Gelatin." 3 p., 10 ill. (*The Labors of a Modern Hercules.* Hercules Powder Co., Inc., Wilmington, Del.) Describes the methods employed in making dynamite.

Explosives

Commercial Explosives; Their Safe and Proper Use. 48 p., 12 ill. (Form 293, Hercules Powder Co., Inc., Wilmington, Del.) Discusses and illustrates explosives of various types, their selection, use and storage, and accessory equipment such as blasting machines, galvanometers, and rheostats. A set of rules for handling explosives is included.

"Du Pont Plant Facilities." 6 p., 11 ill. (*The Du Pont Magazine.* E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.) Describes and illustrates some of the plants devoted to the making of du Pont products.

Piping

Oxwelded Piping; For Industrial Installations; For Domestic and Industrial Heating Systems. 20 p., 41 ill. (Linde Air Products Corp., New York, N. Y.) Discusses the advantages of welded piping, where economy, lightness, freedom in layout, speed in erection, minimum resistance to flow, freedom from leakage, and low maintenance charges are sought.

Slate

"The Production of Slate for the Builder's Use." 3 p., 4 ill. (*The Du Pont Magazine*, Nov., 1929. E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.) Describes the plant and operations of the Structural Slate Co. at Pen Argyl, Pa.

Tanks

Zelnicker's Bulletin. 8 p., 3 ill. (No. 394, Walter A. Zelnicker Supply Co., St. Louis, Mo.) Lists various types of tanks in capacities ranging from 65 to 100,000 gal.; air compressors; and miscellaneous machinery.

Johns-Manville Corporation

This company has just taken a number of options covering small sections of land between two large parcels which it has owned for some time at Asbestos, Quebec. This action is part of a twenty-year development program of the Corporation's mining property. A comparatively small sum of money is involved.

Basalt Rock Company

A statement in the San Francisco *Daily Commercial News* states that certain of this company's first mortgage, 7 per cent sinking fund gold bonds, due December 1, 1933, have been drawn for redemption on December 1, 1929, at 101 and interest at the Anglo-California Trust Co., of San Francisco. The numbers of the bonds drawn are: for $1,000 each, M-14, 25, 34, 40, 47, 56, 68, 79, 88, 95 and 113; for $500 each, D-2, 7, 10 and 15.

Western Salt Company

All of the outstanding first and refunding mortgage 7 per cent gold bonds, due June 1, 1937, have been called for redemption on December 1, 1929 at 105 and interest at Franklin-American Trust Co., St. Louis, trustee.

TRAFFIC NEWS AND COMMENT

Lime

In the final report of the Interstate Commerce Commission, in Docket No. 19,957 and proceedings consolidated therewith, the Commission prescribed a new schedule of rates on lime—common, hydrated, quick, slacked, burnt or fluxing—carloads, from Ohio producing points to Trunk Line and New England Territories (east of Buffalo and Pittsburgh).

The Commission denied the allegation of unreasonableness in the past and confined its findings to the future. The rates as found unreasonable for the future will result in a general readjustment of rates to a large consuming territory, which have been in effect for a number of years.

It also denied the allegation that the intrastate rates maintained between points in Pennsylvania resulted in undue or unreasonable preference.

Gravel

The complaint of Arkansas gravel producers, alleging discrimination due to the Louisiana state rates, has now reached the United States District Court for the Eastern District of Louisiana.

A short synopsis of the proceeding thus far is as follows:

The Louisiana state rates on sand, gravel and other materials for public works have been materially lower than the Interstate rates.

Complaint was filed with the Interstate Commerce Commission by the Arkansas gravel producers.

The Interstate Commission found for the complainants, but the Louisiana Commission contended that the discrimination, if any, applied only in the northern tier of parishes and issued its order accordingly.

The Louisiana railroads have instituted injunction proceedings which were set for hearing a short time ago, and it was said the Louisiana Highway Commission intended to intervene.

The court findings are not yet known, but will be of great interest on account of the question of jurisdiction between state and federal regulating bodies being the controversy involved.

Roofing Slag

New rates on roofing slag, to be established not later than December 30, have been prescribed by the Interstate Commerce Commission in Docket No. 21,646 from points in the state of Pennsylvania to New England.

The new rates prescribed are not to exceed the rates shown below, subject to the addition of 70 cents per ton to the rates for hauls involving car float or lighterage service in New York Harbor:

Distance—	Rate per Ton
125 miles and over 100 miles	$1.50
150 miles and over 125 miles	1.60
175 miles and over 150 miles	1.75
200 miles and over 175 miles	1.85
230 miles and over 200 miles	2.00
260 miles and over 230 miles	2.10
290 miles and over 260 miles	2 25
320 miles and over 290 miles	2.35
350 miles and over 320 miles	2.50

No. 22,691. **Dewey Portland Cement Co.**—Rates and charges in violation of Sections 1, 3 and 13 of the Act on Cement from Davenport, Des Moines, and Valley Junction, Ia., to South Dakota points as compared with rates from Rapid City, S. D.

No. 22,710. **Medusa Portland Cement Co.**—Rates and charges in violation of Sections 1 and 3 of the Act on Cement from York, Pa., to New York, N. Y., Jersey City, N. J., and all points within free lighterage limits of New York. Competitors at Sweedland, Northampton and other points in Lehigh District of Pennsylvania said to be preferred.

No. 22,771. **Falling Springs Lime Co.**—Seeks just and reasonable rates on carload shipments of ground or pulverized limestone or marl from Barber, Va., to points in Maryland, New Jersey, Delaware, Pennsylvania, New York, Ohio, Illinois, Indiana, West Virginia, and District of Columbia.

No. 22,791. **Terry and Lewis Sand and Gravel Co.**—Seeks establishment of just, reasonable, non-prejudicial and non-preferential rates on sand and gravel from Gladstone, Ill., to Iowa destinations.

Fluxing Stone

The question of rates on fluxing stone prescribed by the Ohio Commission a short time ago for intrastate movements has been brought to the attention of the Interstate Commerce Commission by certain carriers.

The carriers' contention is that the rates prescribed by the Ohio Commission gives the Ohio shippers an undue preference and, by the reduced rates from Ohio producing points to Ohio consuming points, the definite relationships of consuming points of Ohio and Pennsylvania in the Mahoning Valley is broken up.

Generally, the steel producers in the Mahoning and Shenango Valley group have been placed on a parity, whereas the adjustment complained of disrupts this adjustment of long standing and places the Pennsylvania steel producers at a disadvantage and does not give them the same treatment as their competitors in Ohio.

Adjustment under the cooperative agreement is sought before any action is taken to place the subject in litigation.

Rate Relationships

While our readers will not be greatly concerned with the rates on coal, nevertheless we make mention of Interstate Commerce Commission Docket No. 18,183 involving the relationship of rates to E. St. Louis, St. Louis, and beyond.

The object in referring to this proceeding which involves a low grade, heavy, loading commodity is to point out what may be in the minds of the Commission in order to dispose of controversies between producing points and complaints by producers against the rates from their own and their competitors shipping points in order to strengthen their hold on primary markets.

In the instant case, reference was made by the Commission to mileage rates as a cure, but the complainants stated this would result in disaster to the industry. The Commission asked if the disaster would be greater than that which now prevails and that query was answered by the statement that it would exclude distant producing points from big markets.

The Commission then asked if the industry would not have to initiate the closing of some producing points as a step to the elimination of controversies before the Commission regarding relationships.

What is true of coal might also be said of other mined or quarried materials and the thoughts in the minds of the Commission should be considered before proceedings are initiated as a continual wrangling between competitors for advantages might result in mileage scales which would certainly restrict each producer's operators to a limited territory and might be worse than what he now has.

REVIEW OF FOREIGN PRACTICE

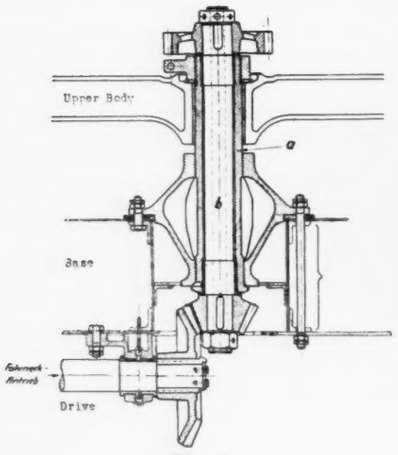


Fig. 1

Small Size Shovel Excavators

In quarrying heavy soils, the use of bucket chain and large shovel excavators has been practiced. But actual tests have shown that small shovel excavators (about ½ cu. yd. capacity) used alone give good results with heavy material. The grabbing power is developed mainly by the lifting apparatus and varies considerably in windlass strength depending on the position of the shovel. For the ½-cu. yd. shovel, a windlass power of 18,000 lbs. is required. For working heavy ground, a cast steel base plate of sufficient strength is of great importance. Equally necessary is the joint between the upper, revolving carriage and the base. The rotation of the upper car takes place about a vertical axle (Fig. 1) so constructed that the middle pinion operates both the traction and dumping power. This is accomplished by means of the hollow shaft *a*, which is firmly bound to the lower truck, and holds both parts of the machine together. The driving axle *b* passes through this shaft. Figures 2, 3 and 4 show some shovels of this type. Fig. 2 illustrates a caterpillar diesel driven shovel operating in very heavy slaty soil; Fig. 3 is a similar shovel, electrically driven. Four shovels of this type have a daily capacity of 1,800 cubic yards. Fig. 4

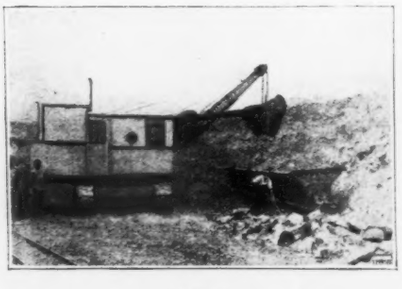


Fig. 2

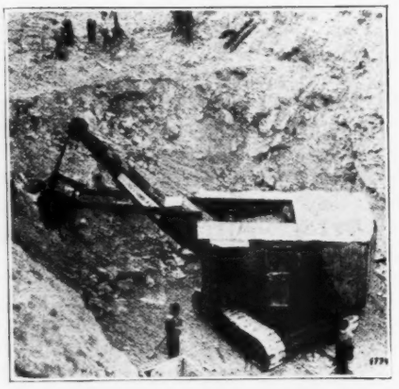


Fig. 3

shows a caterpillar diesel driven shovel quarrying the boulders in a river bed which has been thoroughly frozen by a heavy frost. K. Weissemmel (*Tonindustrie Zeit.* October 7, 1929).

Cement Testing

Fig. 5 shows the iron press molds used by the author for testing standard cement sand mixes. It should be noticed that these rectangular test pieces are *pressed*, not cast. Fig. 6 shows the Hebel modification of Feret's apparatus for testing the bending strength of the small pressed prisms. The breaking load in the bucket measures the resistance to bending. H. Kühl (*Tonindustries-Zeitung*, September 26, 1929).

Varieties of Gypsum

Raw gypsum (the double hydrate) with two molecules of water, plaster of paris with ½ molecule and anhydrite with no water of hydration constitute the known varieties. Anhydrite may be water soluble or insoluble. The soluble variety does not occur naturally but is formed when the raw dihydrate is heated to a determined temperature. It can also be made by grinding the insoluble anhydrite to an extremely fine state of division. At 108 degrees C., the water of crystallization of the raw gypsum begins to evaporate, and the first 1½ molecules of water will split off. This splitting is possible only when the solution pressure exceeds the vapor tension above the gypsum hydrate. A temperature of 128 degrees C. (262 degrees F.) is the usual one for the burning of crude gypsum to plaster of paris. K. A. Goslich (*Tonindustrie Zeit.* October 7, 1929).

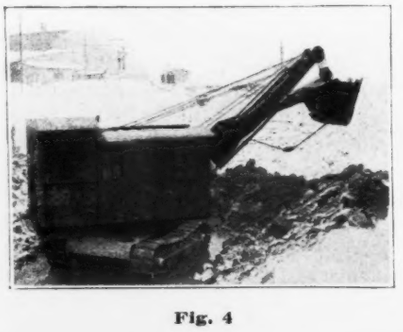


Fig. 4

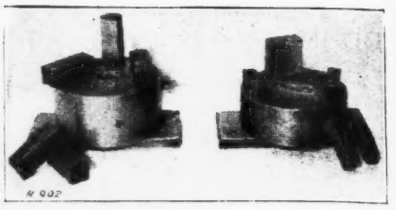


Fig. 5

Paper Sacks for Cement

The cement industry has had thus far no good results in the use of paper sacks for cement, as, especially in summer, they become brittle in a very short time, resulting in difficulties when exported. As a very large amount of cement was packed this way, as trials in exporting cement in six ply paper bags were undertaken, it is up to the paper industry to supply a product more suitable for this purpose. The size used should be more elastic and the permeability to air should be lessened. This latter property is, perhaps, of less importance than devising seams which will stand up. Hi. (From Report of O. Dyckerhoff, *Zement*, October 3, 1929.)

Impact Pulverizers

An impact pulverizer of the heater type has an annular fixed screen 16, formed on an endwise extension of the mill casing and means 25 (Fig. 7) are

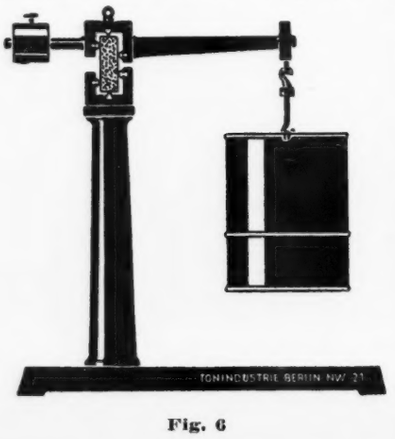


Fig. 6

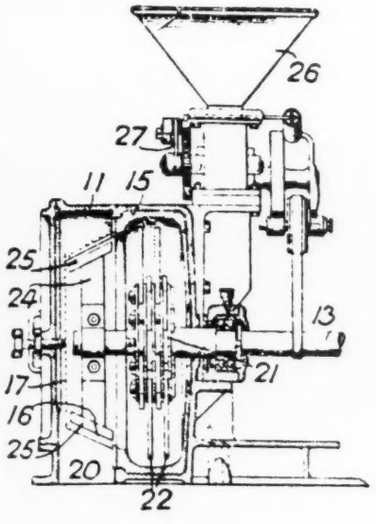


Fig. 7

provided for returning unscreened material back to the beater ring. The material in the hopper *26* is fed into the side of the mill casing by a pawl and ratchet type feeder *27*. The beaters 22 are pivoted on rings 21 fixed to an overhung shaft 13 and revolve in a corrugated casing 15 provided with a framework extension 16 covered with screening material 17. Blades *25* on arms *24* are fixed to the shaft 13 and revolve inside the screen *16*, the blades *25* being angled to direct unscreened material back into the beater ring *15*. The screened material is discharged through an outlet 20 in the casing 11. An access door is made in the side of the casing. J. P. Van Gelder. British Patent 317,446.

Pit Props

A mine prop is formed of two hollow or solid members *a*, *b* (Fig. 8) with inclined abutting faces *c* retained in contact by a two part rotatable sleeve *e* each part of which is provided with corresponding inclined abutting faces, so that when the whole of the abutting surfaces register, the two parts of the prop may be moved laterally with respect to each other. The sleeve is disposed between collars *d* fixed to the members. In order to prevent the two members becoming entirely separate an external chain attached to each is used or alternatively a pivoted link *h* is used having a pin and slot connection *k* with one part and with bearing surfaces *n* to contact with the internal sides of the members in the collapsed position. The lower portion of this link rests on a spring plate which is depressed during collapse and helps to restore the prop to working position again. When the members are hollow, side fillings *o* of wood are disposed on each side of the link and these fillings are also provided with inclined contacting faces at the joint.

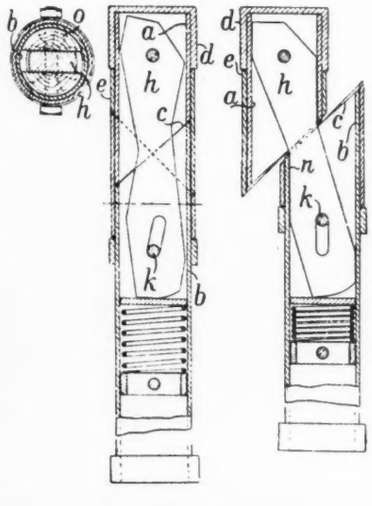


Fig. 8

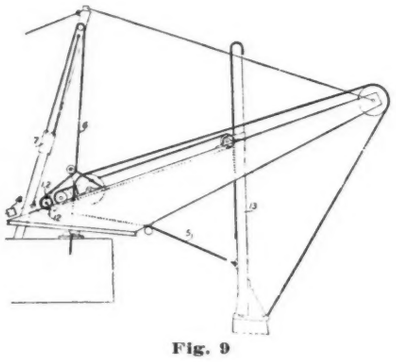


Fig. 9

Removable packing may be used in the lower end of the prop to enable its length to be varied. J. H. Bramah. British Patent 317,146.

Scoop-Arm Excavating Machines

In an excavator in which the dipper-arm is operated by a motor on the boom, the motor is also utilized to operate the backing rope. As shown in Fig. 9, the backing rope *5* and a rope *6* connected to a slideable counterweight 7 are oppositely wound round connected drums 1, 2, or a single drum, and the drums or drum may be connected by a clutch to a shaft 12 driven by the motor 4, by which the dipper arm 13 is operated. Fleming & Gerguson, Ltd., and W. S. Appleton. British Patent 316,075.

Roller-and-Breast Mills

In a grinding mill having a grinding bar or block *e* arranged longitudinally of a grinding roll *d*, a feed hopper *b* disposed above the roll is provided with a partition element *a*, Fig. 10, so arranged as to remove material which has passed between the grinding roll and bar and allow it to accumulate until it overflows the partition on to the grinding roll for the purpose of a repeated grinding. The scraper *a*, Fig. 1, is mounted on a shaft *c* and is maintained in contact with the roll by a torsion spring *f*, not shown, and may be withheld from the roll by a latch *i*, engaging a handle *h*. The material after passing between the bar *e* and roll *d* adheres to the surface of the roll and is carried round to the hopper *b*, where it is removed by the scraper *a*, the material gradually accumulating between the scraper *a* and the wall of the hopper until it overflows and mixes with the material in the hopper from which it is reground. The hopper *b* is subdivided by a partition *k*, the space between the partition and roll being closed by the pivoted scraper *l* which may be mounted in a manner similar to that of the scraper *a*. The part *m* of the hopper is filled with material to be ground and a shallower layer is placed in the other division *n* on top of the grinding roll *d*. Clockwise rotation of the roll *d* carries the material under the bar *e* and round to the back of the machine into the space *m* whereby it is scraped off the roll by the blade *l*, increasing thereby the contents in the space *m* and causing same to overflow into space *n*, from which it is again ground. This process is repeated until the whole of the contents of the hopper *b* is sufficiently ground; the blade *l* is then pivoted to the position shown in broken lines and the contents collected by a scraper on the roll in known manner. A. E. G. MacCallum. British Patent 316,907.

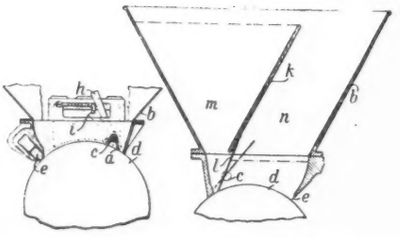


Fig. 10

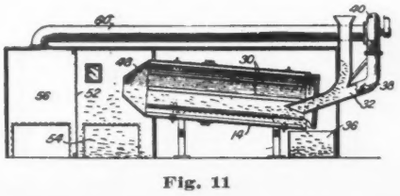


Fig. 11

LATEST NEWS FLASHES

Allis-Chalmers Appoints New Distributor

T. B. Wood's Sons Company has been appointed by the Allis-Chalmers Manufacturing Company as its special distributor at Chambersburg, Pa. This company is in position to make proper recommendations and to render prompt, efficient service in Texrope drives and belts.

Fate-Root-Heath Builds New Factory Unit

The Fate-Root-Heath Company, (Plymouth Locomotive Works), Plymouth, Ohio, manufacturers of industrial and railway locomotives, has just completed a large new factory unit, of steel and brick construction. New equipment, which is being installed, will double the present output of the well-known Plymouth gear drive gasoline and diesel locomotives. The company manufactures also gas-electric and diesel-electric locomotives of from 20 to 100 tons.

Mining Building Dedicated at Lafayette College

The John Markle Mining Engineering Hall, a new building on the campus of Lafayette College, Easton, Pa., will be formally dedicated Friday and Saturday, December 6 and 7, at which time there will be also a conference on The Relation of Mining Education to Industry.

Developing Fuller's Earth in Alabama

The Choctaw Clay Corporation of New Orleans, La., with a plant near Meridian, Miss., is planning further development of fuller's earth deposits in Choctaw County, Ala., along the main line of the Alabama, Tennessee and Northern Railroad.

This company's officers are: president, R. J. Wilkinson, of New Orleans; vice-president, D. B. Williams, president of Yellow Pine Piling and Pole Company, New Orleans; vice-president, John P. Wilkinson, president of Visco Petroleum Corporation, New Orleans; secretary and treasurer, L. M. Dalgarn, president of L. M. Dalgarn Construction Company, New Orleans. Directors in addition to the officers are: W. H. Lindsey, president of Napier Iron Works, Nashville, Tenn., and J. G. Miller, Sr., of New Orleans.

Colorado Cement Plant Closed Temporarily

The plant of the Ideal Cement Company, near Fort Collins, will be closed November 1 for a period of at least two months, according to an announcement by Ira J. Dilts, superintendent.

Northwest Limestone Deposits

Large, newly found limestone deposits have been located recently in Chelan County, Wash., near Lake Wenatchee. These are owned by John D. Atkinson and Fred Burgess, of Telma, Wash. They cover 1,000 acres and are estimated to have 300,000,000 tons of white, snow-flake marble limestone, averaging about 96 per cent carbonate of lime, with very little magnesia, well-suited for use as building marble and in manufacturing high-class portland cement. There are abundant alumina shales in the vicinity for cement purposes. There is available abundant water on the property for all electric-power purposes in the making of cement, both for grinding, and for burning. Engineers have claimed that electric burning is practical and much cheaper than with the coal or gas.

G. H. Williams Company Moves Chicago Office

The G. H. Williams Company, builders of clamshell and dragline buckets and heating torches, announces removal of the Chicago branch office to new and larger quarters, at 614 Peoples Gas Building. This change was made necessary by increased service facilities provided for Williams customers in the middle west. C. F. Weiblen, manager of the Chicago office, is in charge.

Well-Known Periodical Changes Publication

The veteran mining periodical, Engineering and Mining Journal, is about to inaugurate a new policy in the matter of its frequency of publication. Effective January, 1930, this magazine will be issued semi-monthly instead of weekly. A separate weekly publication will be known as E. & M. J. Metal and Mining Markets. These two periodicals are intended for subscribers in American territory. To serve subscribers in foreign districts a new magazine, Engineering and Mining World, will be published monthly.

Five New Distributors for Chain-Belt Company

The Chain Belt Company announces the distribution of its Rex chains and transmission equipment through five new distributors in the Southeast. The Bailey-Lebby Company of Charleston, S. C.; The George Supply Company of Savannah, Ga., and Jacksonville, Fla.; Harry P. Leu Company of Orlando, Fla.; and the J. M. Tull Rubber and Supply Company of Atlanta, Ga., are the new distributors. Specializing in Rex equipment for power plants, fertilizer plants, cement mills and food packing houses, they will handle and stock the complete line of Rex chains and auxiliary equipment.

California Company Reorganizes

The Pacific Rock Company, of Centerville, Calif., is being reorganized and the name changed to Centerville Sand and Gravel Company. E. W. Burr of Hayward is president and M. T. Scott is manager of the new company. Plans are to erect two new plants in the future.

Prehistoric Relics Found in Indiana Gravel Pit

Three bones recently found in the Anderson Theobold gravel pit near Vincennes, Ind., were said by geologists to be part of a mastodon skeleton. Mastodon teeth had been previously unearthed in the same locality

Paver With Folding Mast

Contractors engaged in grade elimination work or in the construction of retaining walls or foundations which are long, some distance apart and several feet above the ground are finding in the Ransome 27-E Paver with folding mast plant a desirable portable mixing and placing unit.

The big feature of this unit is that the mast is hinged and can be folded down to travel under telephone wires or bridges. To raise or lower the mast the paver loading skip is used, making the operation simple and easy.

Concrete is raised in a hoist bucket of 1-cu. yd. capacity. The hoist for raising the bucket is attached to the paver and is driven from the paver power plant; the control levers for the hoist and brake are located so one man standing on the regular operator's platform can operate the mixer and mast bucket.

NEW MACHINERY AND SUPPLIES

Allis-Chalmers Builds 300-ft. Kiln

The Wolverine Portland Cement Company of Coldwater, Mich., recently purchased from Allis-Chalmers Manufacturing Company, Milwaukee, Wis., a 10 ft. diam. rotary kiln, 300 ft. long.

This kiln is designed with five supporting tires, and the carrying mechanisms are of the two-roller type, oil lubricated. The purchase of this kiln is in line with the plans of this cement company to make extensive improvements at their Coldwater property. It is expected that this kiln will be shipped in December of this year, and under the direction of L. L. Stone, consulting engineer, Detroit, Mich., the kiln will be ready for operation in the early part of 1930.

Tractor Shovel Unit

The Trackson McCormick-Deering Shovel unit which is shown in the picture is employed by many clay and rock companies and proves an efficient combination for handling clay, sand, shale, and crushed rock.

The bucket may be obtained either with a low lift, for stripping, digging, picking up and carrying materials; or with a high lift for loading trucks, wagons and dump cars. A single unit will replace from four to a dozen men with hand shovels on operations of this kind, and as many as four teams of horses. The low and high lift attachments are readily interchangeable, making it possible for the owner to use both with a single power unit. Also, they do not interfere with the tractor's use for drawbar work.

For operation in difficult ground conditions where wheel tractors cannot work, the shovel is mounted on a Trackson Crawler-equipped McCormick-Deering. The crawlers provide a sure footing and positive traction in soft, loose ground, slippery clay and mud.

The unit which is shown in the picture is one of a fleet of four Trackson Shovels owned by the American Fire Brick Co. at Spokane, Wash. The machines are employed in the company's clay pits, where they pick up and move the clay and shale from the field which is being worked to the chute leading to the trap below.

A New D. C. Counter E. M. F. Automatic Starter

A new counter e.m.f.-type automatic starter, for small d.c. motors on general applications, is announced by Cutler-Hammer, Inc., 189 Twelfth St., Milwaukee, Wis. This new, small motor starter incorporates a number of new and important features such as: small size, reduced voltage starting, thermal overload protection, low voltage protection and renewable silver contacts. It is rated up to 2-hp., 115 or 230 volts. The contactors are designed especially for direct-current service, and the renewable silver contacts insure long life. Each starter is supplied with a separate pushbutton master switch providing three-wire remote control. Two-wire control can be furnished if desired.

Automatic Starter

The starters consist of a main-line contactor, an accelerating contactor, an armature resistor, and the thermal overload relays. On depressing the "start" button of the master switch, the main line contactor connects the motor to the line through the armature resistor. As the motor accelerates to the proper point, the counter e.m.f. of the motor armature closes the accelerating contactor which cuts out the armature resistor, connecting the motor across the line.

The stadard starter is supplied with thermal overload relays, but starters without the relays are also available. The overload relays are the same as those used in this company's A.C. automatic starters for small motors. They are of the fusible alloy type and can be made applicable to various size motors, by simply changing the heater coils.

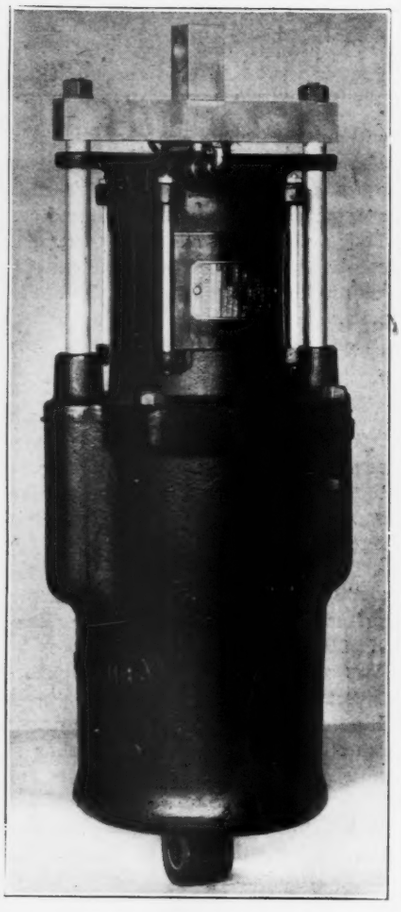
The Hydraulic Operator

The hydraulic operator, a new and interesting industrial control device developed by the General Electric Company, will make its initial appearance at the National Machine Tool Exposition in Cleveland.

The hydraulic operator takes the place of large alternating- or direct-current magnets and solenoids and may be used also to replace air cylinders where quiet and smooth upward thrust is desired through a given distance. It consists of a motor-driven centrifugal oil pump, the impeller of which is mounted in a piston and driven by means of a spline shaft. This arrangement permits the stationary mounting of the motor. The normal position is with the piston at the bottom of the cylinder which is approximately two-thirds full of oil. When energized the motor drives the impeller creating a pressure between bottom of the piston and bottom of the cylinder.

The piston is cast so that the oil is fed to the center of the impeller from both the top and bottom. The oil is forced from the end of the impeller blades through ports to the space below the piston. The pressure tends to move the piston upwards and it will travel the full length of the cylinder providing the load on the ends of the push rod is not too great.

Shovel mounted on a tractor



Hydraulic operator

The operators are rated on the stalled thrust basis; that is, the number of pounds they will balance when the motor is running at full speed. The speed of operating is slower than that of a solenoid, but is relatively fast.

The device can be applied to brakes, clutches, door and window openers, spot welders, pumps and other places now filled by solenoids and air cylinders.

New Idling Device

An automatic idling device or throttle control for regulating speed of engine in Lincoln "Stable Arc" welders of the gasoline-engine driven type has been perfected by The Lincoln Electric Company, Cleveland, O. The new device automatically increases the speed of the engine from normal idling speed to the proper speed for welding service whenever the arc is struck. When welding is discontinued, the device automatically reduces speed of engine to normal idling speed.

The operating mechanism of the device consists principally of a small metal bellows and an electric magnet. When the arc is struck the armature of the electric magnet opens a relief valve in the bellows causing them to inflate which in turn allows a coil spring to open the engine throttle. When welding operation ceases the bellows are deflated by suction of engine intake, thus causing the closing of the engine throttle to idling position. The idling device is provided with a control lever which may be set for automatic throttle control, for continuous idling speed or for governed speed.

New Six-Cylinder Heavy-Duty Truck

The latest addition to the comprehensive line of Mack trucks is a new six-cylinder truck designed for those fields where divertisified hauling requirements demand power, capacity and high, safe speed. The new Model BC does not supplant any existing Mack model, but is instead a modern addition to a modern line.

Some of the interesting features of the new six cylinder engine are: a combined fan and water pump mounted at the front of the cylinder block, both driven from the one belt; crankcase ventilation provided by a flexible tube extending from the valve cover plate to the elbow on the carburetor intake; throttle control of the exhaust heat applied to the inlet manifold through a jacket on the riser; and thermostatic temperature control.

Hascrome Welding Rod

The Haynes Stellite Company of Kokomo, Indiana, has placed on the market a manganese - chrome - iron welding rod called Hascrome. This is a self-hardening alloy, designed primarily for building up badly worn parts preparatory to surfacing them with Haynes Stellite, which is also supplied in the form of welding rod. Since the cost of Hascrome is materially less than that of Haynes Stellite, the resulting composite surface is much cheaper than if entirely built up of the latter alloy. Hascrome may be used for building up large sections of steel or cast iron, and forms an excellent base for Stelliting because it is sufficiently hard to resist deformation under impact, and because of the ease with which Haynes Stellite flows onto it. Although in some cases Hascrome alone may be used for hard-surfacing parts subject to abrasive wear, it does not possess red hardness to the same degree as Haynes Stellite, and it will wear away more rapidly. The new alloy is also being used for tacking Haystellite—the Haynes Stellite Company's diamond substitute—to the cutting and reaming edges of oil well drilling tools.

New One-Ton Auto Truck

LaFrance-Republic has entered the one-ton truck field with a 6,000-lb. straight rating truck. Outstanding features of this Republic Model A-1 are as follows: a 58 horsepower six-cylinder, truck-type engine four-speed, heavy duty transmission; four-wheel hydraulic brakes, internal expanding; six-inch frame; bevel gear rear axle; 132-inch wheelbase; balloon front tires—truck-type rear tires; generous road clearance; low center of gravity; easy steering; metal spoke wheels; speed; acceleration; operating economy.

Scrapping With Oxy-Acetylene Blowpipe

Scrapping is an important economic consideration in many industrial plants today. An interesting job recently completed was the scrapping of 167 obsolete locomotives and tenders, by this method. But seven oxy-acetylene operators were needed to accomplish this task. All sorts of cutting problems were successfully solved, from light weight steel to heavy forgings. Even the cast iron parts such as weight bars and wheels were cut by means of the torch. All the material was reduced to charging-box size with the exception of the boiler tubes. These were salvaged and welded into lengths of two to make pipe sections suitable for low pressure or for electric conduit. The brass and copper fittings were separated from the iron and steel and sold as separate scrap.

Scrapping by this modern method affords quite a contrast to that used some ten or twenty years ago.

Locomotive scraps after use of acetylene torch